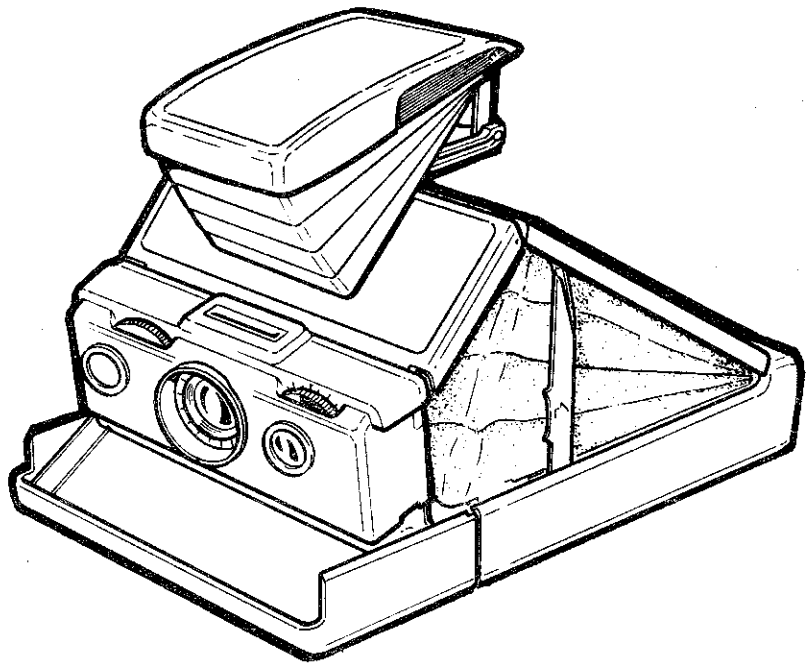
REPAIR MANUAL

SX-70 CAMERA

1st. REVISION: NOVEMBER 1973



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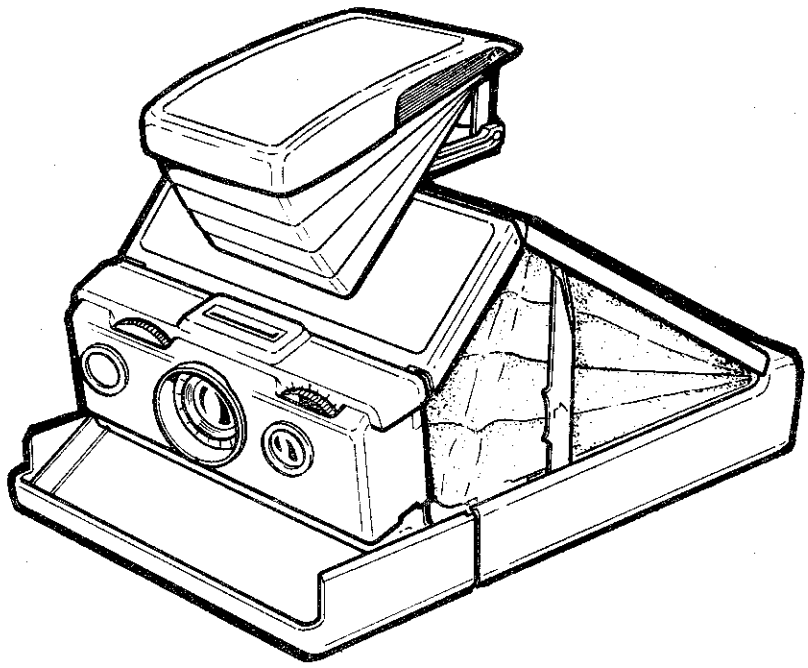

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FOREWORD

This Technical Services Manual incorporates many features in addition to the Basic Camera Instruction Manual. It is divided into the following sections:

Section I	—	Description
II	—	Theory of Operation
III	—	Troubleshooting
IV	—	Repair and Adjustments
V	—	Configuration Control
VI	—	Repair Information Bulletins
VII	—	Defect Codes
VIII	—	Numerical Parts/Price List
IX	—	Tools and Test Equipment
X	—	Service Policies and Practices

INTRODUCTION

The SX-70 Camera system design, function and operation incorporates a number of radical departures from previous Polaroid products.

Automation

Once a pack of film has been inserted into the camera, the operator has to perform only three functions:

1. Open the camera.
2. Focus for a sharp image.
3. Press the exposure button.

There is no waste material to handle. The print is ejected automatically and develops correctly outside the camera. There is no negative to dispose of and no need to measure the development time.

Direct Positive Prints

Since no negative is involved in the film processing, the SX-70 produces a direct-positive color print. This imposes a design requirement incorporated in the camera. The image, after passing through the lens, is reflected onto the film surface by an optically-flat, first surface mirror. This reverses the image so that the final print is viewed in correct left-to-right orientation. Since it is in the optical path, any flaws or degradation of the mirror surface will degrade the quality of the finished picture.

No Battery Requirement

Camera failure due to battery failure has essentially been eliminated. Inclusion of the battery into each film pack has eliminated the attention needed to satisfy power requirements. From the maintenance point of view, however, the condition of any test packs or power supplies must be considered.

Reflex Focusing

The production of sharp pictures becomes a function of the photographer's ability to focus a sharp image on the Fresnel screen. There are no rangefinder coupling mechanisms requiring checks or adjustments.

Exposure Control

The SX-70 camera employs no aperture or aperture adjustment. The light-controlled shutter establishes the correct exposure in a fashion unique to this camera. The only device similar to previous Polaroid cameras is the inclusion of a wedge-controlled LIGHTEN/DARKEN adjustment on the photocell to compensate for slight deviations in film speed or unusual lighting situations.

Motor-Driven Film Handling

To provide the degree of automation featured in the SX-70 camera, a number of functions must be accomplished by means of an electric-motor drive system. The system incorporates the high-speed, d-c motor plus a series of gears, levers, and switches – all of which constitute a design departure from previous products.

Miniaturization

One of the features offered by the SX-70 camera is the incorporation of single lens reflex focusing, large picture size, and complete automation in a minimal size package. This has been accomplished by the use of miniaturized components and, in the electronic assemblies, integrated circuits and modern techniques.

Comparison with other Cameras

The foregoing paragraphs indicate the inadvisability of attempting direct comparisons with other Polaroid cameras. Common repair techniques can be employed in many cases, but trouble analysis and repair procedures must be accomplished with minimum reference to previously prepared maintenance documentation.

It is, therefore, mandatory that the repairman read and understand the descriptive material contained in Sections I and II of this manual. Because of the degree of automation employed, minimal analysis of malfunctions can be accomplished without the use of special test equipment and checkout procedures. For this reason, a typical troubleshooting chart will seldom pinpoint the malfunctioning component. As a result, Section III describes testing procedures and correlates the results with probable corrective measures.

Once the malfunction has been isolated, the procedures in Section IV describe the repairs in detail. A considerable amount of redundancy has been employed in Section IV to eliminate cross-referencing so that the repair can be accomplished without the need to leave the pertinent segment of the manual.

The Illustrated Parts Breakdown is provided with a separate cover sheet and discreet page numbers so that, if desired, it can be used as a separate document. It is, however, referenced as Section V of the manual.

This manual has been prepared for use in conjunction with a specially prepared SX-70 training course and, for this reason, neither should be considered adequate without the other. A number of procedures require the development of physical sensitivity to the hardware that defies description and illustration. Having experienced the needed "touch" during the training period, the manual becomes reference for recalling the details of the procedure and establishes correct sequencing of individual operations.

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10. Again rotate the gear train in the counterclockwise direction until the Fresnel carrier returns to the viewing position.
11. Check the camera for proper operation.
12. Reinstall the bottom cover. Install and tighten the four screws.
13. Replace the front cover by squeezing the sides of the front cover just enough to engage the pivot points.
14. Check the camera for proper operation.
15. Replace the decorative leather covering on the bottom cover.

E. ERECTING LINK, REMOVE

A single link is employed to secure the camera in the picture taking configuration when the camera is manually opened to that position. Since the angular relationship of the mirrors, lenses, and all other optical components is critical, a broken or distorted erecting link can seriously affect the camera performance.

A broken erecting link spring can also adversely affect the optical system because the link will not be firmly held in its proper position. If there is evidence of mechanical distortion or looseness of the erecting link, the link must be replaced. The following paragraphs describe the correct procedures:

1. Erect the camera to picture taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover close to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Carefully peel the leather decorative covering from the bottom cover.
5. Remove the four screws from the bottom cover.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small, metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Peel the decorative leather covering from the mirror cover assembly.
9. Refer to Figure 4-17. Remove the two link-retaining screws.
10. Remove the boot-retaining screw indicated in Figure 4-17.

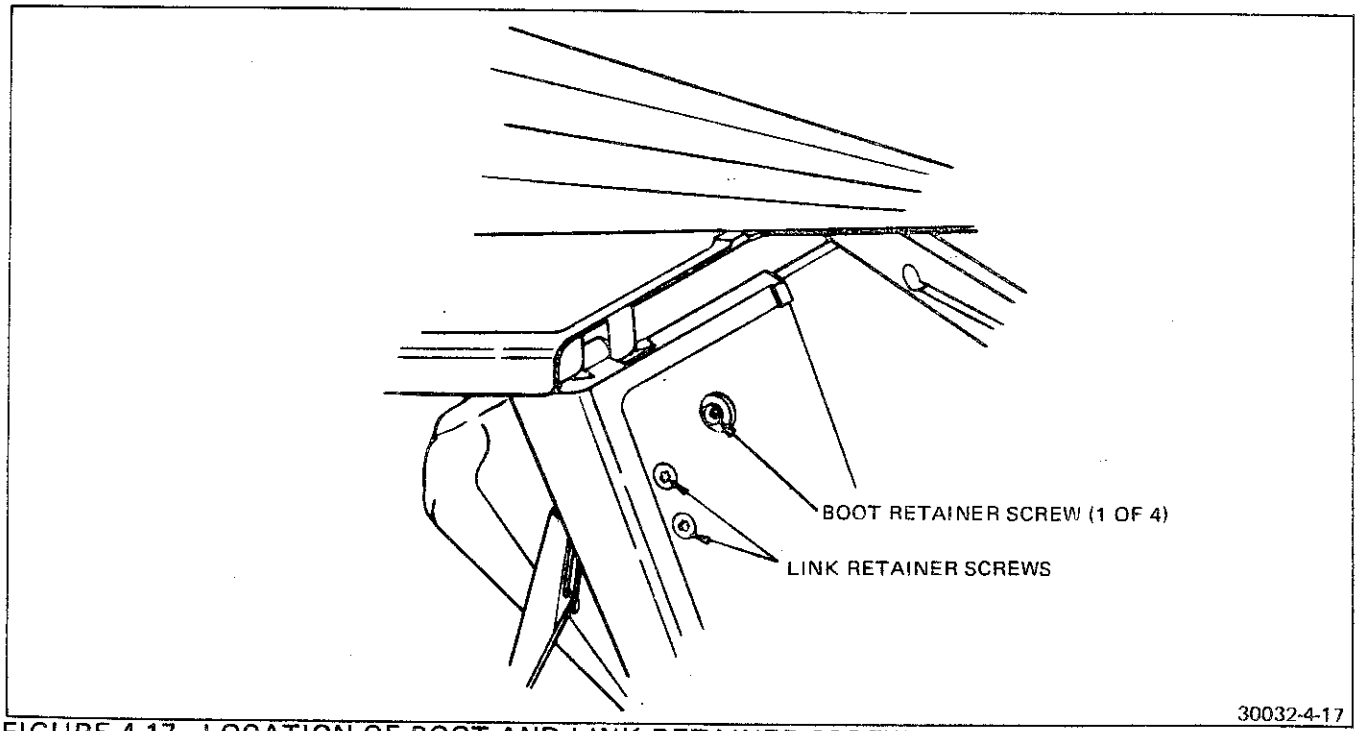


FIGURE 4-17 LOCATION OF BOOT AND LINK RETAINER SCREW

11. Release the erecting link from the open camera locked position.
12. Slide the spring end of the link toward the end of the cover and lift the spring end of the link from its mounting position.
13. Slide the opposite end of the link to the end of its slot so that the roller can be withdrawn through the hole provided for the purpose.

F. ERECTING LINK, INSTALL

1. If the erecting link is undamaged but a new spring is needed, refer to Figure 4-18. Note that the coiled portion of the spring snaps over a small projection on the link assembly.
2. Insert the link roller into the hole at the end of the curved slot and slide the link into position.
3. The hinged foot at the spring end of the link must be positioned under the edge of the boot. Use the blade of a small screwdriver to lift the boot just enough to insert the link.
4. Install the three screws through the mirror cover.
5. Any time that the erecting link is disturbed for any reason, a stigmatic pupil adjustment must be performed. Adjust the entrance pupil in the manner described in paragraph 3B-14 (Figure 4-19).
6. Replace the decorative leather covering on the mirror cover.
7. Slide the bottom cover into place.
8. Install and tighten the four cover retaining screws.
9. Replace the decorative leather covering on the bottom cover.
10. Squeeze the sides of the front cover just enough to engage the pivot points.
11. Close the cover and check the camera.

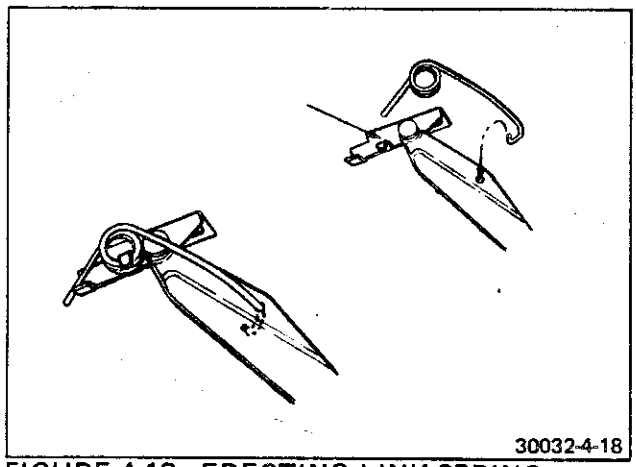


FIGURE 4-18 ERECTING LINK SPRING-INSTALLATION

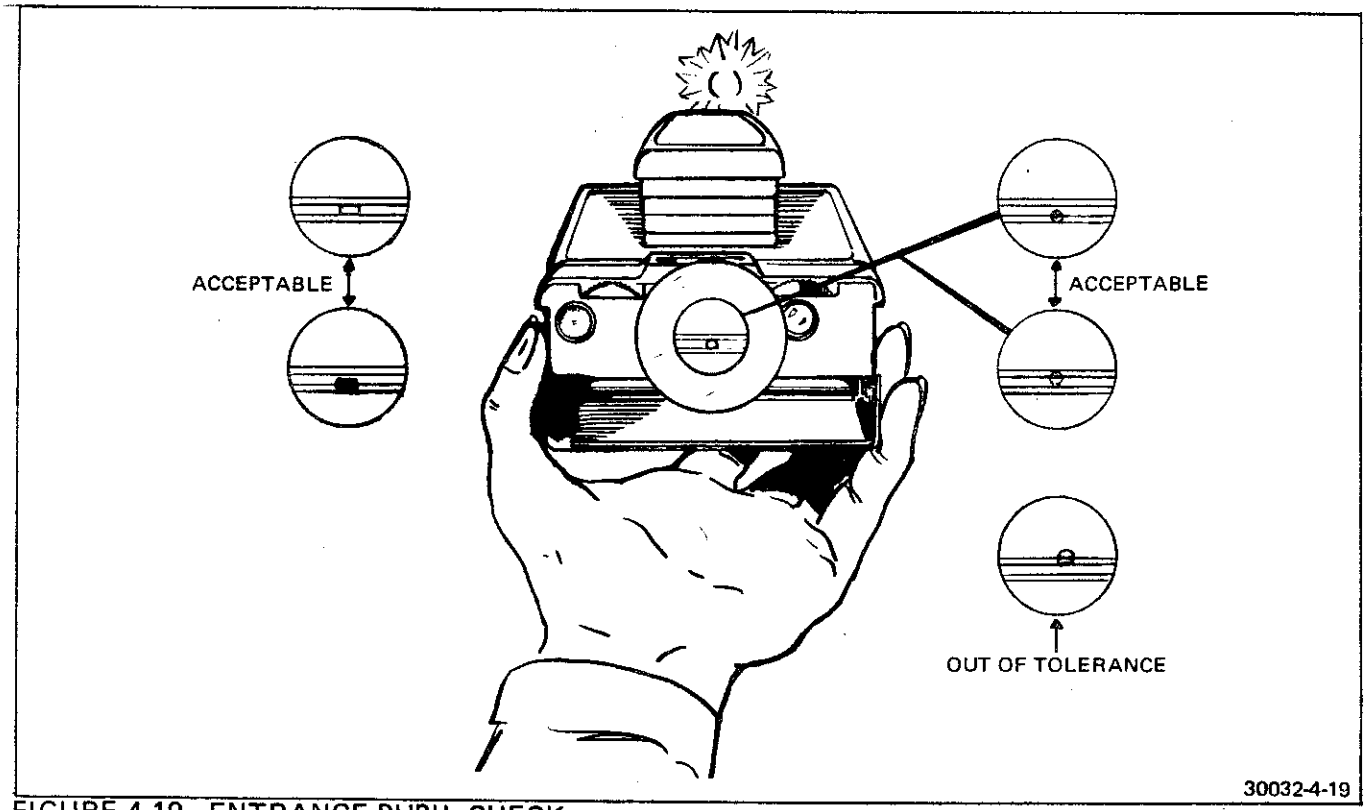


FIGURE 4-19 ENTRANCE PUPIL CHECK

G. VIEWFINDER SYSTEM (SHORT COVER ASSEMBLY)

The SX-70 camera is a single-lens-reflex type and, as such, the viewfinder system involves the picture-taking lens, the reflex viewing mirror, the Fresnel viewing screen, and the eyelevel optical system. The latter system is housed in the folding short cover assembly. In the short cover assembly, the optical components consist of the eyelens, a parabolic mirror, and the stigmatic pupil stop. These optics function to bring the Fresnel image into sharp focus at the photographer's eye. The optical path is indicated in Figures 4-20 and 4-21.

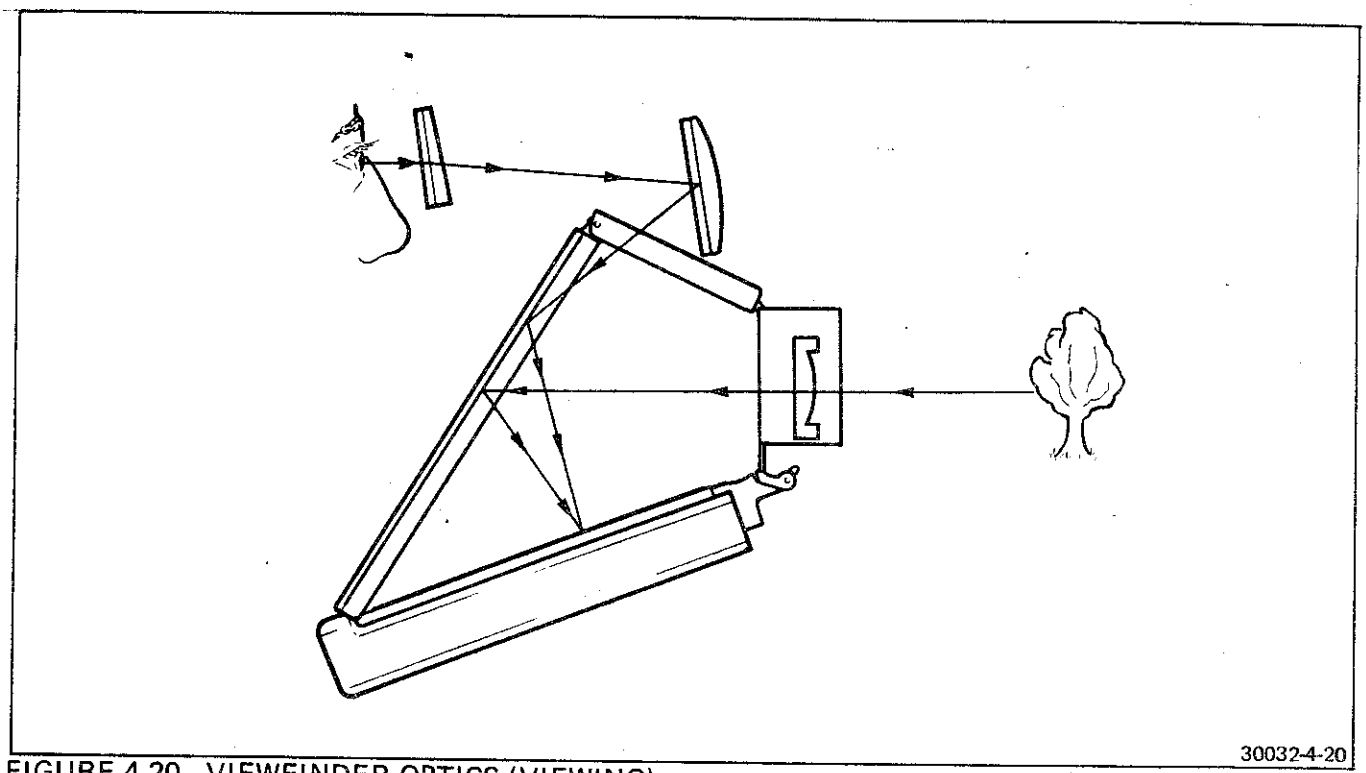


FIGURE 4-20 VIEWFINDER OPTICS (VIEWING)

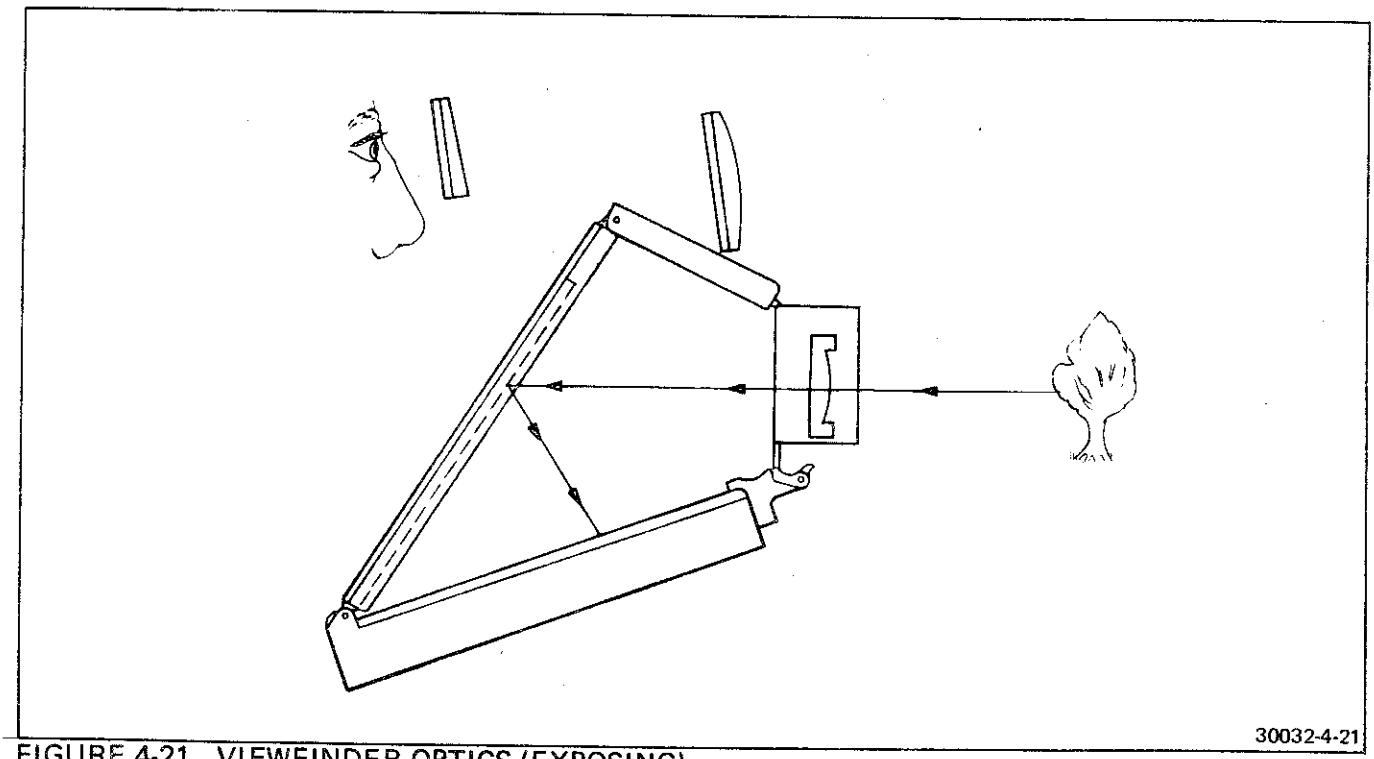


FIGURE 4-21 VIEWFINDER OPTICS (EXPOSING)

A visual inspection of the short cover assembly will reveal any broken or bent components. If the optical components are damaged or displaced, it will be impossible to obtain a sharp view of the Fresnel image. In either situation, the viewfinder must be repaired or replaced.

The following paragraphs describe the removal and replacement of the individual components.

1. Eyelens with Housing, Remove.

If the eyelens has been damaged, the lens in its housing can be removed and replaced without removing the other viewfinder components.

a. Extend the camera to picture-taking configuration.

b. Using the Special Tool #11712 (Figure 4-22) press out either end of the three-piece pivot pin until the pin emerges far enough to permit inserting a jeweler's screwdriver underneath the head of the protruding pin and pry out.

NOTE: In the following step, the eyelens torsion spring will be released. Do not lose the spring.

c. There is sufficient slack in the lens erecting system to permit tilting the eyelens housing a few degrees. Tilt the housing sufficiently to release the center pivot pin from the assembly.

d. Slide the eyelens housing toward the hinged ends of the erecting links until the pivot studs on the lens housing line up with the large clearance holes at the ends of the slots in the links.

e. Tilt the erecting assembly slightly and release first one and then the other pivot stud, and remove the lens and housing.

f. Remove and retain the center section of the three-piece pivot pin and the torsion spring.

2. Eyelens with Housing, Install

a. The lens and its housing is replaced as a unit. Pass the two lens housing pivot studs through the holes in the erecting links, and slide the housing down to the ends of the slots.

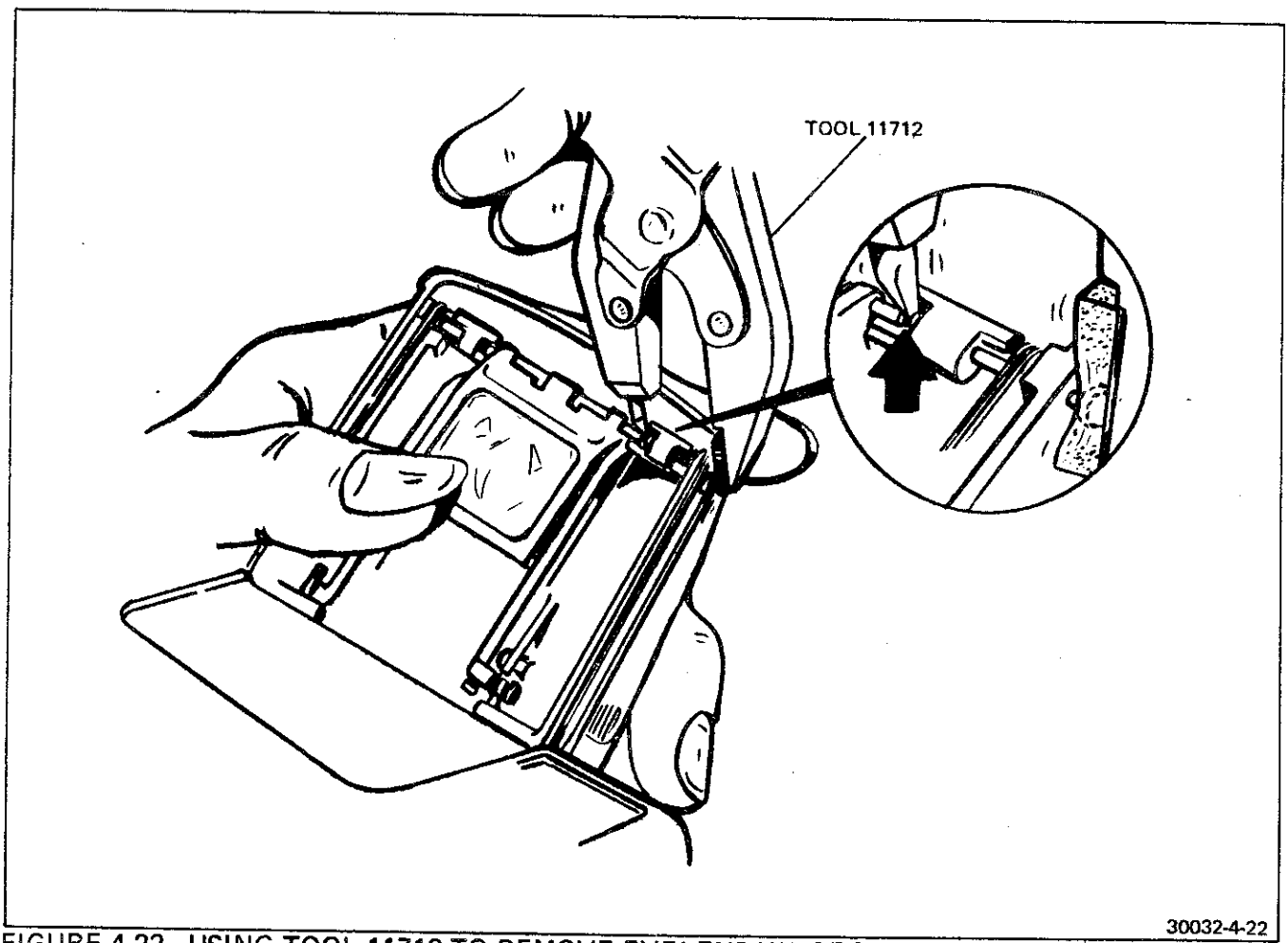


FIGURE 4-22 USING TOOL 11712 TO REMOVE EYELENS HINGE PIN

b. Locate the two spring ends in the housing as shown in Figure 4-23.

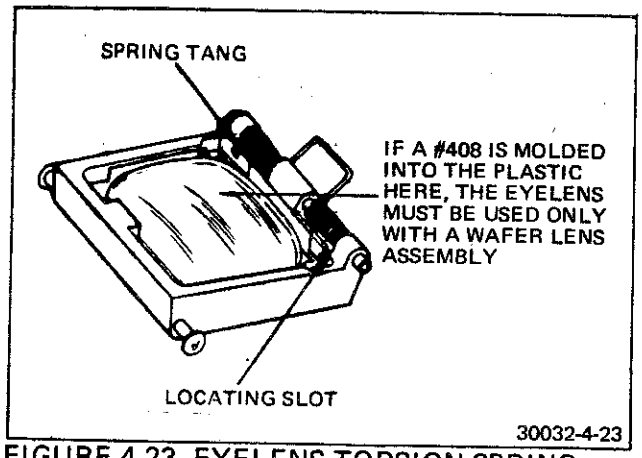

SPRING TANG
IF A #408 IS MOLDED INTO THE PLASTIC HERE, THE EYELENS MUST BE USED ONLY WITH A WAFER LENS ASSEMBLY
LOCATING SLOT
30032-4-23

FIGURE 4-23 EYELENS TORSION SPRING

c. Lay the lens and erecting links flat against the camera body and install the torsion spring and center section of the pivot pin.

d. Refer to Figure 4-24. Line up the ends of the center pivot-pin section with the grooves in the viewfinder cap. Torsion the spring and, at the same time, press the lens housing down so that the ends of the pivot pin rest in the grooves.

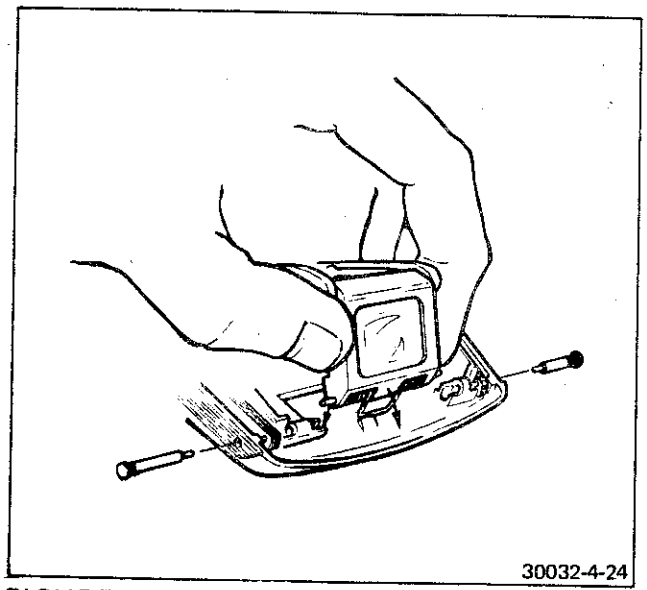


FIGURE 4-24 INSTALLING SPRINGS

e. Holding the lens housing in place, insert the two remaining sections of the three-piece pivot pin.

f. Gently tap the pins into position so that the ends of the pins are flush with the outside of the viewfinder cap.

g. The eyelens must be compatible with a stigmatic pupil or wafer lens.

3. Concave Mirror Housing

The concave mirror is the optical device that bends the image rays from the Fresnel viewing screen to direct them to the eyelens. If the mirror is displaced or damaged, it will be impossible to obtain a proper view of the Fresnel image. Replace the concave mirror and housing in the following manner:

a. Open the camera to its picture taking configuration.

b. Using the Special Tool #11712 (Figure 4-22) press out either end of the three-pivot pin until the pin emerges far enough to permit inserting a jeweler's screwdriver underneath the head of the protruding pin and pry out.

NOTE: In the following steps, a number of separate components will be released. To prevent loss of these items, hold the assembly together with one hand while removing pins with the other.

c. Once the pivot pins are removed, slowly raise the eyelens assembly. Remove the viewfinder cap by twisting the cap from the concave mirror studs.

d. Holding the concave mirror in place, bring the two rear projections of the shade blade assembly forward until the two tabs leave the two slots at the front of the short cover. Remove the shade blade assembly.

e. Allow the concave mirror housing to swing back until the spring tension is removed and the housing can be lifted from the viewfinder.

f. If the spring is in good condition, install the spring on the replacement concave mirror housing. See Figure 4-25.

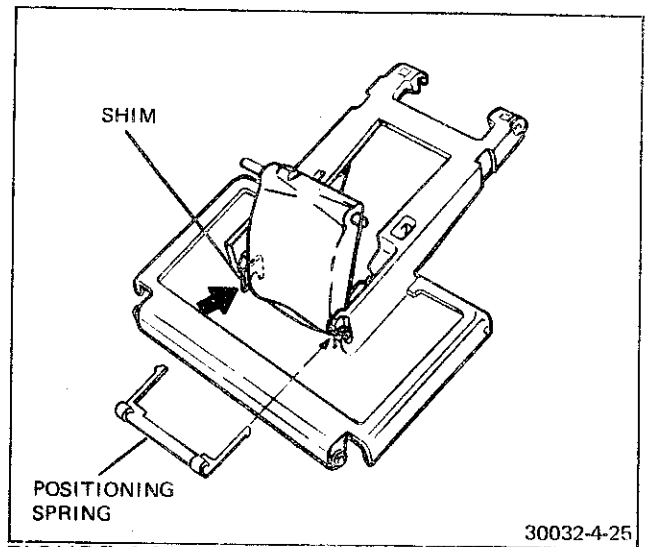


FIGURE 4-25 ORIENTATION OF SHIM AND POSITIONING SPRING

g. The mirror housing has two short studs on one side and two long studs on the other. Note that the flat side of the studs line up with the slots in the housing. Refer to Figure 4-25. Insert the lower short stud into its slot on the left side of the short cover.

h. Lower the bottom long stud into the right side slot making certain that the spring lies between the two vertical barriers in the short cover and does not interfere with the swing of the mirror housing.

NOTE: Refer to Section III, E5 for details on shim/positioning spring.

i. Insert the two tabs of the shade blade assembly into the two slots in the short cover and swing the assembly down until the two holes line up with the pivot pin holes in the viewfinder housing. The front edge of the shade blade assembly will raise the concave mirror housing to the vertical position.

j. Hold the shade blade assembly in this position. Hold the viewfinder cap at an angle and insert the upper short stud on the mirror housing into the curved slot in the left hand track.

k. Swing the viewfinder cap around until the long stud of the mirror housing will enter the curved slot of the right track. The hooked end of the spring must be outside the track.

l. Two hook tabs on the front upper edge of the shade blade assembly engage two projections inside the front edge of the viewfinder cap. Tilt the cap downward so that it folds down the mirror housing and, at the same time, slide the cap rearward to pick up the shade blade tabs. Lower the cap until the pivot-pin holes are correctly aligned.

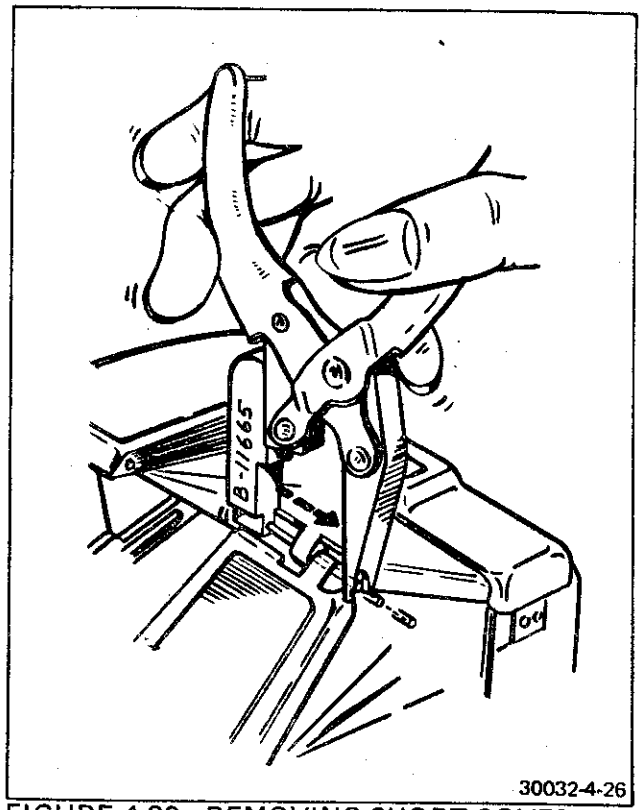
m. Align the center section of the three-piece pivot pin assembly (with the eyelens housing and the torsion spring in place) with the pivot pin holes in the shade blade assembly and the viewfinder cap. Install the two outer pivot pin sections.

4. Eyelens Erecting Links

The eyelens erecting links form a part of the eyelens-housing erecting system. They are removed and replaced in the following manner:

a. Use Special Tool #11665. Remove the mirror-cover-to-short-cover hinge pins (Figure 4-26).

b. Remove the eyelens housing as described in paragraph 1, steps b through f.



30032-4-26

FIGURE 4-26 REMOVING SHORT-COVER-TO-MIRROR-COVER HINGE PINS

c. Raise one of the erecting links until the flat on its retaining stud is aligned with the slot in the retainer and lift out the link.

d. Remove the second link in the same manner.

e. Install replacement links by aligning the flats with the slots, inserting the studs into the retainers, and rotating the links.

f. Reassemble the viewfinder as described in paragraph 3, steps c through m.

g. Refer to Section III, E, and make viewfinder quality check.

5. New Design Wafer (Lens) Replaces Older Stigmatic Pupil

The new wafer lens replaces a hole in the viewing system optics, which was known as the stigmatic pupil, with a plastic lens. This change increases the brightness of the viewed image and enhances the clarity of the field of view. To replace the stigmatic pupil with the new wafer lens, proceed as follows:

a. Use the Special Tool #363361 (boot trim gun) to cut out a crescent or half moon shaped opening in the boot. Figure 4-27 gives specific instructions alongside the drawings.

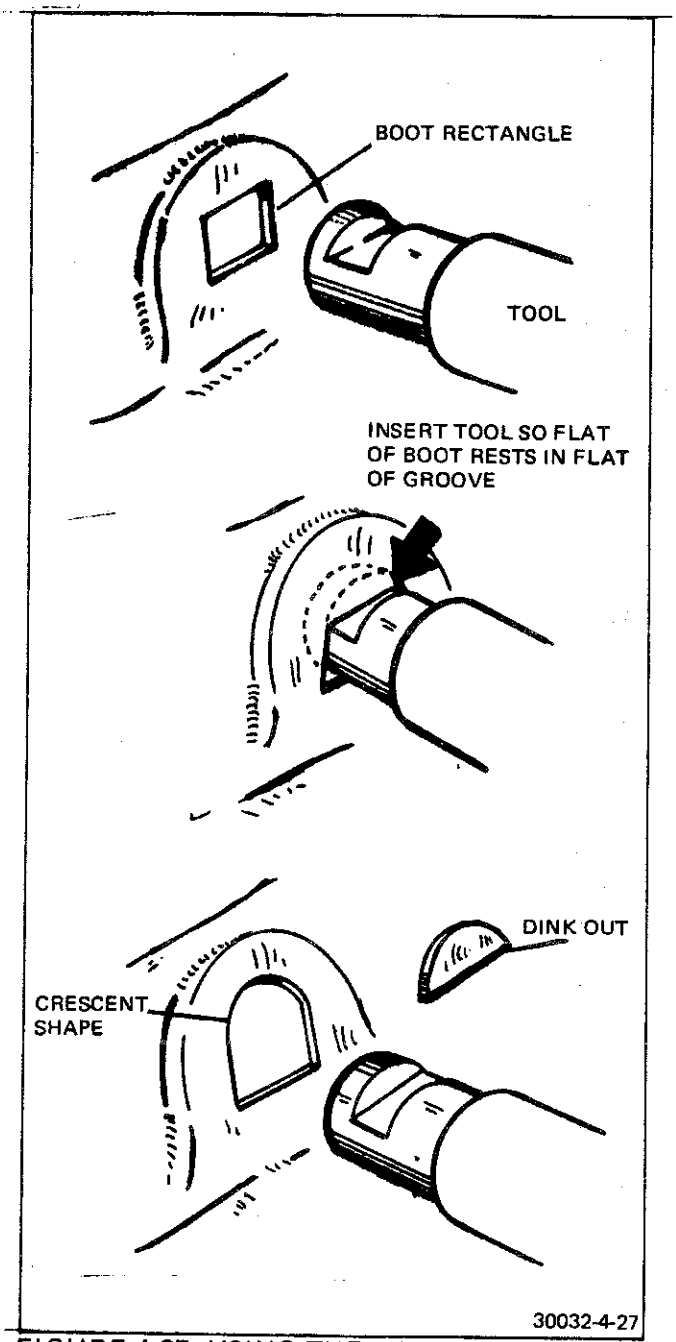


FIGURE 4-27 USING THE BOOT TRIM GUN

b. Insert the top of the tool – slot uppermost – just under the upper edge of the rectangular hole in the boot.

c. Press the tool against the upper edge of the boot hole so that the vertical edge of the rear of the tool slot butts against the boot.

d. Squeeze the tool trigger slowly keeping the tool aligned and cut out the piece of boot.

e. The hole should look like the drawing with a rectangular bottom edge and a crescent top.

f. Remove the stigmatic pupil stop and install the wafer lens in the same place.

g. Install a new eyelens.

NOTE: At the present time and until a supply of the special tools are available, the foregoing process will not be implemented. If a camera has the wafer system installed, repair will be effected only by changing the entire short cover assembly.

Observe carefully if mirror cover assemblies supplied as replacements have the crescent-shaped cutouts. These types cannot be installed on earlier models. If no other mirror cover assemblies are available, the new short cover assembly with the wafer lens must also be installed.

The viewing system occasionally displays a concave mirror distortion in some areas of the scene. If this symptom is observed, proceed as follows:

1. Observe if the camera contains a stigmatic stop or wafer lens.

2. If no wafer lens, replace the Short Cover with #705612 or a modified 705551.

3. If wafer lens, replace concave mirror with #705482 or 705609.

4. Scrap all concave mirrors, #705292 and ship to Waltham.

The configuration must agree as follows: Concave Mirror #705292 with Short Cover 705551 and Upper Camera Back 705468; Concave Mirror 705482 with SCA 705612 and UCB 705613; and Concave Mirror 705609, SCA 705612 and UCB 705613.

Mirror Identification

Old 705292 has:

1. No white chalk mark and
2. Upper right pivot circular, not machined.

New Mirror 705482 has:

1. White chalk mark on housing.
2. Upper right pivot is machined or molded with a flat area. New mirror 705609 has metal retainers.

The RTV replaces resin adhesive, but is interim until all metal retainers are provided. RTV will be usable with split fresnel also.

6. Short Cover Assembly, One Piece Replacement

a. Erect the camera.

b. Open the front cover.

c. Remove the front cover by applying sidewise pressure at the cover hinge area. Press toward

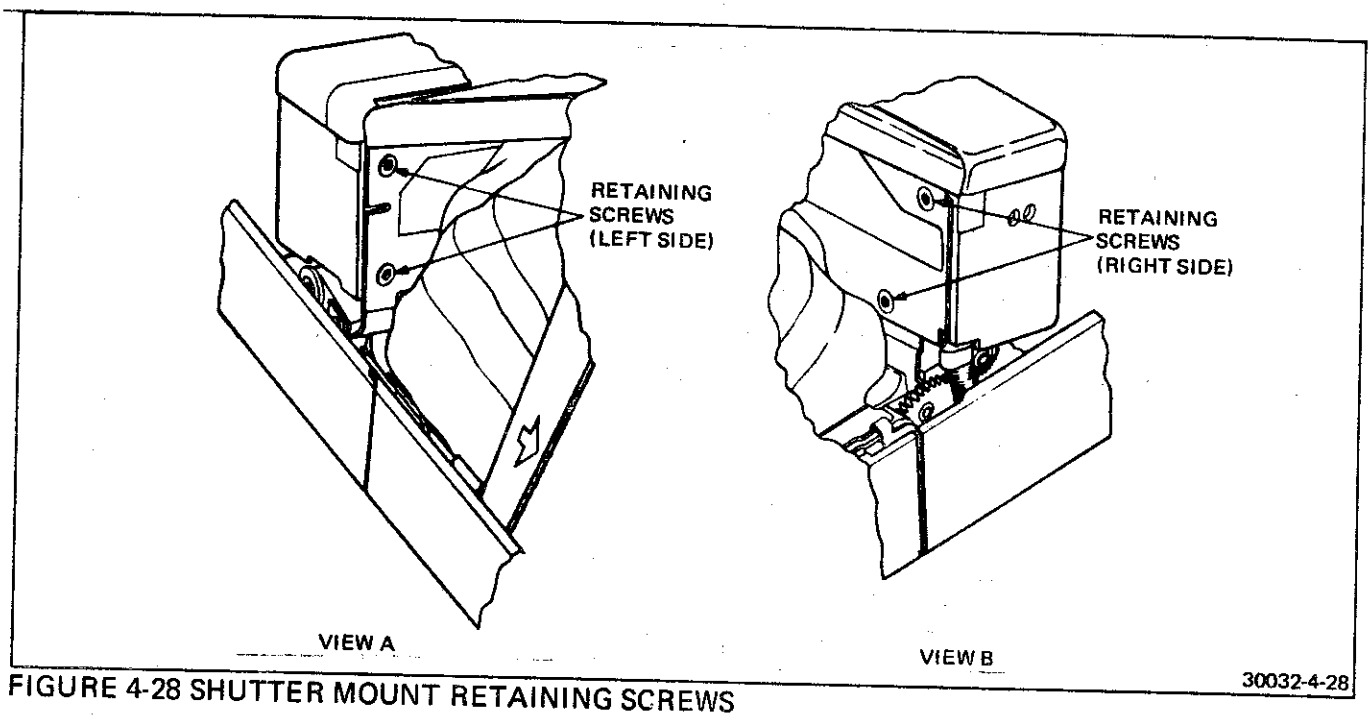


FIGURE 4-28 SHUTTER MOUNT RETAINING SCREWS

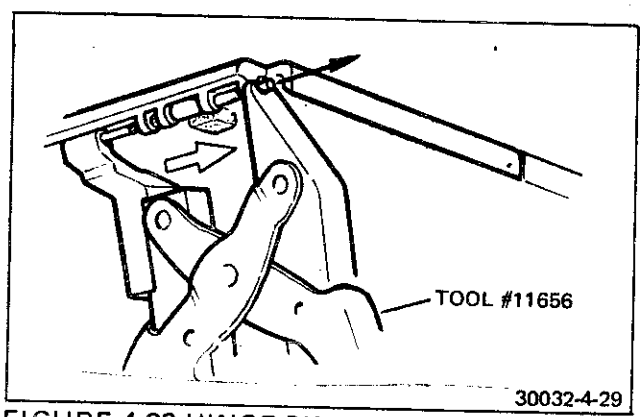


FIGURE 4-29 HINGE PIN REMOVAL TOOL

the gear-train side. This frees the pivot from its mount and releases the front cover. Newer models have front covers removed from the gear-train side.

d. At the back side of the shutter mounting bracket, remove four screws which secure the shutter. (Figure 4-28).

e. When the shutter is loose, lay it aside but make sure not to strain the multi-wire cable.

f. Remove the two (2) short-cover-to-mirror-cover hinge pins, using Special Tool #11665 by inserting it through the separation between the short cover and the mirror cover (Figure 4-26).

g. Collapse erecting link and open forward the short cover assembly.

h. Remove the two (2) shutter hinge bracket-to-short-cover pins with Special Tool #11656 (Figure 4-29).

i. Replace by reversing above procedure.

H. SHUTTER ASSEMBLY, REMOVE

To physically separate the shutter from the camera body, it is necessary to disconnect the multi-wire ribbon cable from the flex circuit. Because this involves a critical soldering operation, any repairs that can be performed with the soldered connections in place should be done in that manner. If the camera malfunction is traced to the shutter assembly, replacement of the unit is accomplished in the following manner:

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Carefully peel the leather decorative covering from the bottom cover.
5. Remove the four screws from the bottom cover.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface.

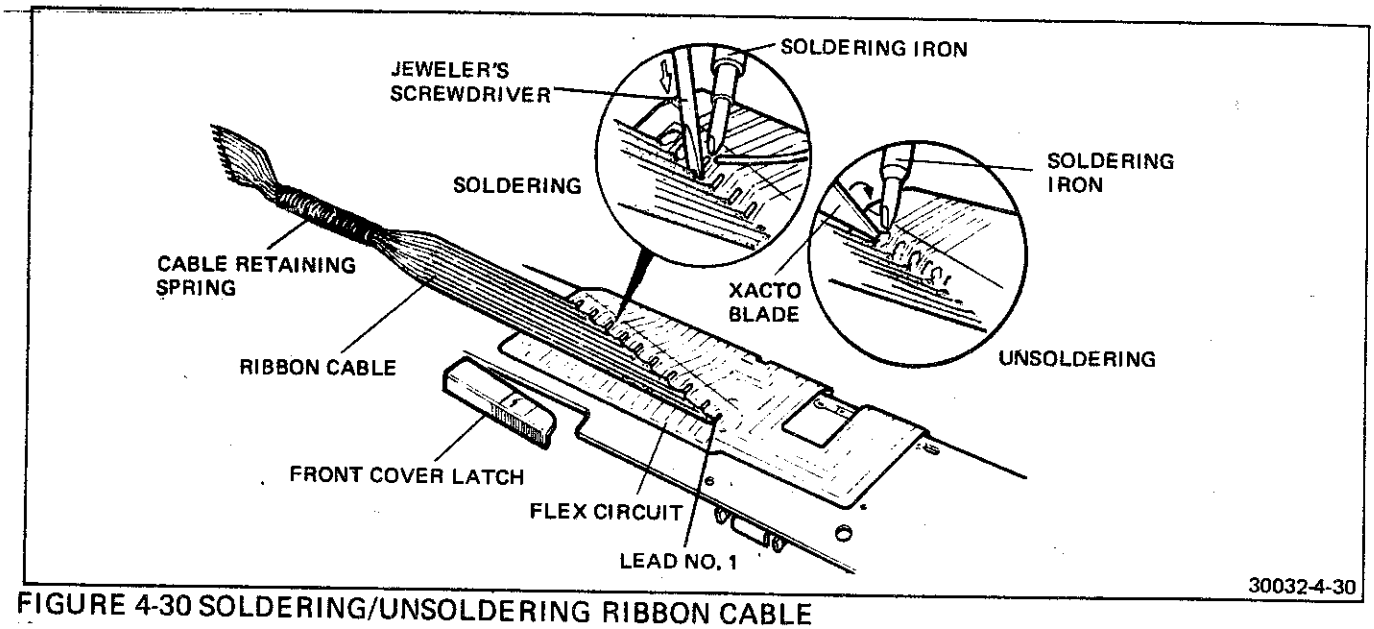


FIGURE 4-30 SOLDERING/UNSOLDERING RIBBON CABLE

Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.

7. Slide the cover from the assembly.
8. Use only the miniature soldering iron specified for this task to guarantee the proper amount of heat applied to connections.
9. Refer to Figure 4-30. Starting with lead No. 1 of the cable, insert the point of a sharp blade (a pointed blade Xacto knife is recommended) under the wire. The sharpened edge of the blade must be held so that it makes physical contact with the junction point of the wire lead and the solder pad of the flex circuit. **Do not** insert the point of the blade beyond lead No. 1.
10. By exerting a slight clockwise twist to the blade, apply upward pressure to the end of the lead.
11. While maintaining a steady upward pressure with the knife blade, bring the tip of the soldering iron into contact with the copper pad on the side of the soldered connection opposite the cable lead.
12. At the instant that the knife blade breaks the solenoid joint, remove the soldering iron. Hold the knife blade steady for a moment to allow the pad and the wire to cool.
13. Repeat steps 9 through 12 for each of the cable leads.

Caution: Under no circumstances attempt to heat and remove more than one lead at a time.

14. Refer to Figure 4-30. Carefully spread the cable clamp just enough to permit removal of the cable retaining spring and slip the spring out of the clamp.

NOTE: To help eliminate previously reported shutter cable 'pinching' problems, a new metal cable cover has been designed. The old K decal is to be discarded.

See Figure 4-31 for method of using. Open the cable clamp, hook the cable retaining spring in place and cradle the cable in the cover as illustrated. Crimp the tabs closed over the spring, but **do not** *crush the spring coils.*

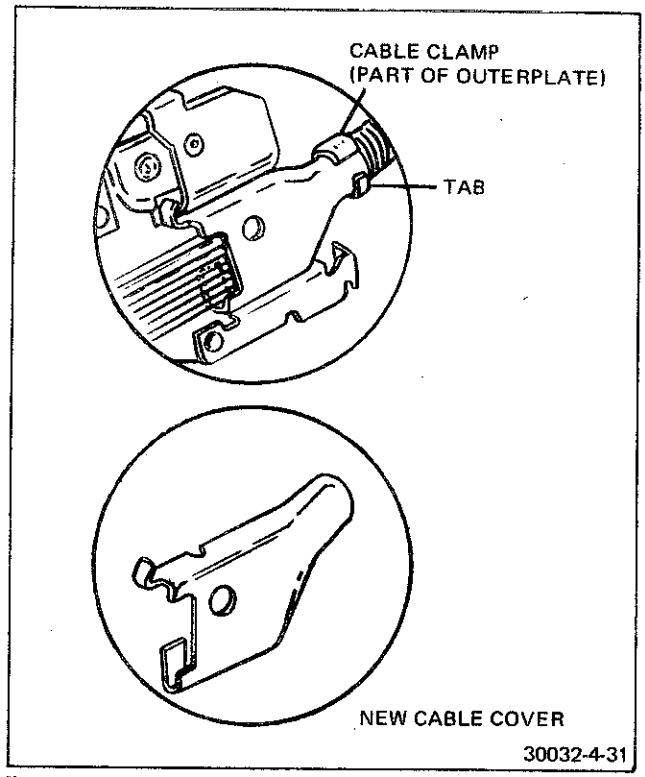


FIGURE 4-31 NEW CABLE COVER

15. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter to the bracket. See Figure 4-28. Lift off the shutter.

I. SHUTTER ASSEMBLY, INSTALL

1. Position the locating pins at the rear of the shutter in the correct holes in the hinge bracket and install the four retaining screws.
2. Dress the multi-wire ribbon cable in the direction of the flex circuit.
3. Locate the short projecting end of the cable retaining spring and the hole at the base of the clamp. Install the spring in the clamp in such a manner that the projection enters the hole in the clamp.
4. Crimp the clamp on the spring with just enough pressure to capture the spring. It does not have to be a tight joint.
5. At the flex circuit solder pads, check for uneven solder distribution and heat and smooth the solder as necessary.
6. Apply a very small amount of Alpha no. 611 flux to the flex circuit solder pads and to the ends of the ribbon cable.
7. Properly orient the cable and dress the end of each lead so that is seats squarely in the center of its solder pad. Hold the cable in this position.
8. Refer to Figure 4-32. Place the blade of a jeweler's screwdriver on top of the bare end of the no. 1 lead exactly at the point where the insulation begins. Press down firmly to create a positive heat sink.
9. Apply the tip of the soldering iron so that it makes simultaneous contact with the pad and the tinned end of the wire lead.
10. Hold the iron in place just until the solder on the wire and the pad flow into a smooth joint.
11. Do not remove the screwdriver blade until the solder has cooled (one or two seconds).
12. Apply a small amount of Alpha no. 1001 Reliasolve Solvent to the soldered contacts and wipe clean and dry with a Q-tip.
13. Check the camera for proper operation.
14. Slide the bottom cover into place.

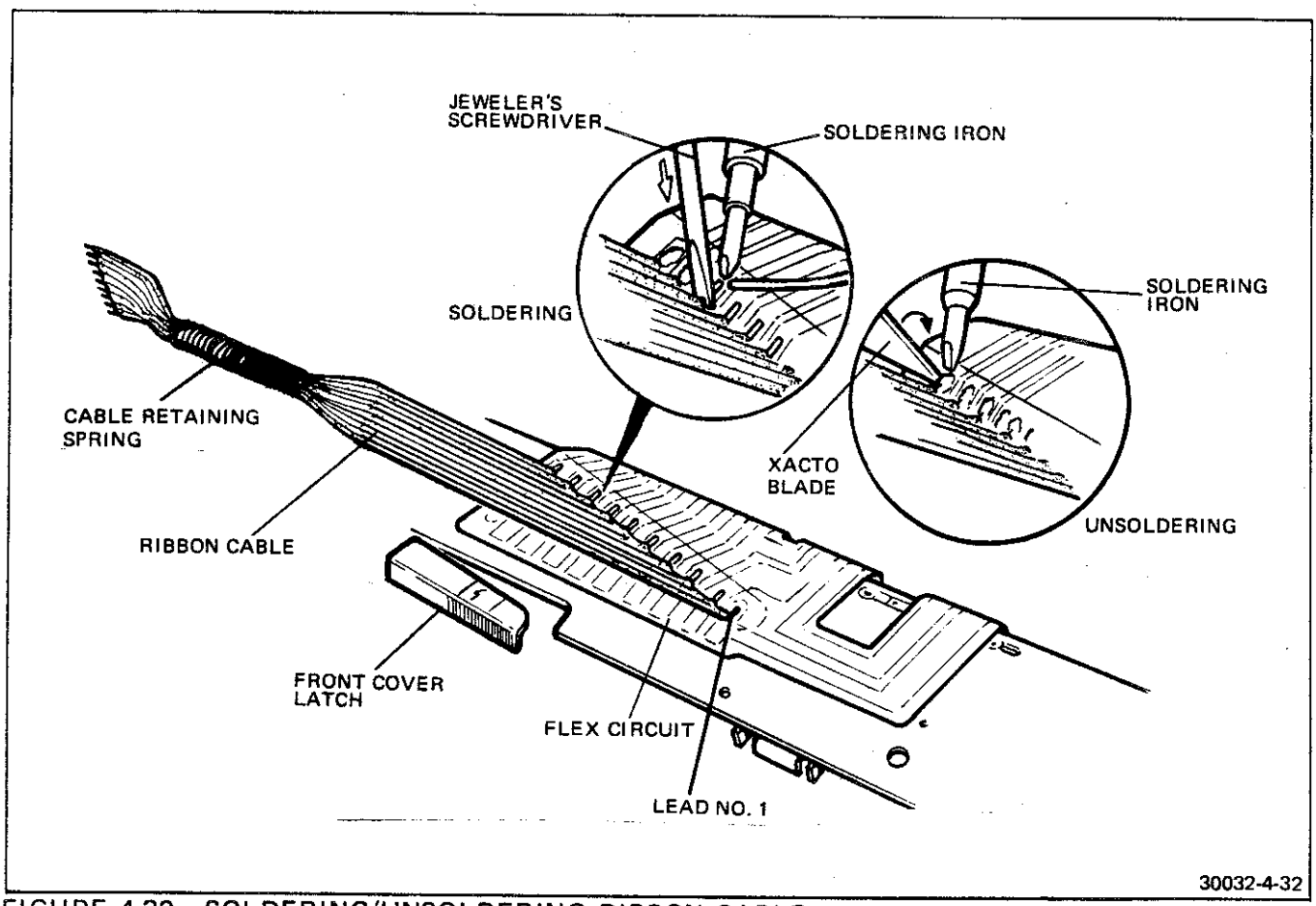


FIGURE 4-32 SOLDERING/UNSOLDERING RIBBON CABLE

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15. Install and tighten the four cover-retaining screws.
16. Squeeze the sides of the front cover just enough to engage the pivot points.
17. Close the cover and check the camera.

J. SHUTTER MOUNTING HINGE BRACKET, REMOVE

Although the shutter mounting hinge bracket is not an externally mounted component, it is subject to damage from improper handling of the camera. If force is used to close the camera without first releasing the erecting link, the hinge bracket (as well as the erecting link) will be sufficiently damaged to necessitate replacement. The damage will be evidenced by failure of the camera to close and latch in the proper manner. The hinge bracket is replaced in the following manner.

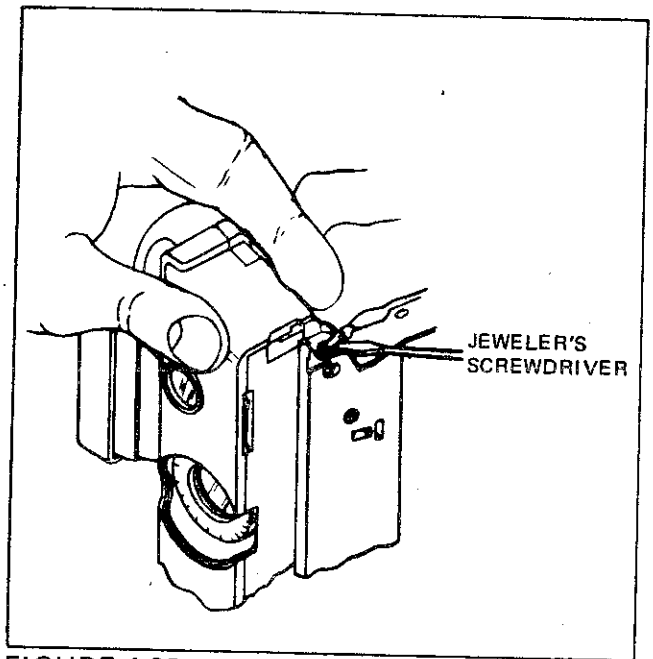

FIGURE 4-33 RELEASING SHUTTER MOUNT HINGE BRACKETS

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front cover release latch on the right side of the camera bed, and remove the front cover.
3. Using the blade of a jeweler's screwdriver, spring the shutter mount hinge bracket on each side just enough to release the pins. See Figure 4-33. This will release the shutter mount from the bottom plate.

   Caution: With the retaining screws removed, the shutter is still attached to the camera flex circuit by the ribbon cable. Handle the camera and shutter with care to prevent damage to the cable.
4. Hold the shutter in place on the hinge bracket and remove the four hinge-bracket-to-shutter-retaining screws.
5. Remove the two hinge-to-boot-retainer screws located adjacent to the round lens opening in the shutter hinge-bracket.
6. Use Special Tool #11656 and remove the shutter-hinge-bracket-to-short-cover hinge pins. See Figure 4-34.

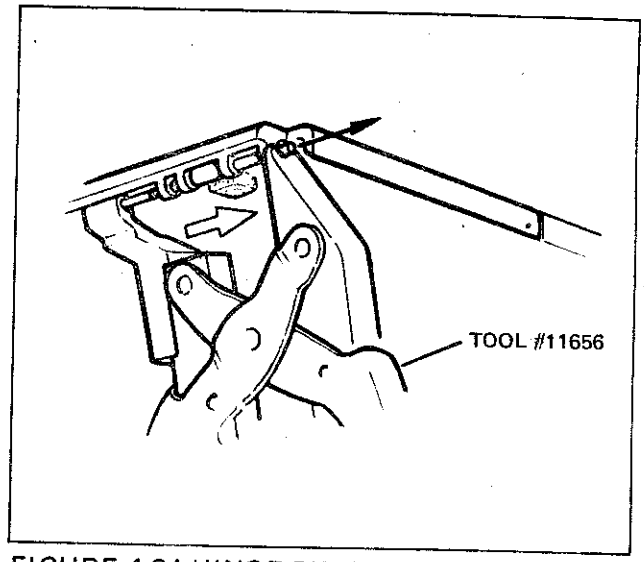

FIGURE 4-34 HINGE PIN REMOVAL TOOL

K. SHUTTER MOUNTING HINGE BRACKET, INSTALL

1. To install the replacement shutter mounting hinge bracket, place the bracket into position, align the bracket hinges, and insert the hinge pins.
2. Tap the hinge pins into place so that the outer ends of the pins are flush with the outer hinge surfaces.
3. Install and tighten the four shutter retaining screws.
4. Using a jeweler's screwdriver, carefully pry each of the two hinges at the lower corners of the bracket just enough to spring the pivot pins into their sockets.
5. Swing the shutter into position on the hinge bracket.
6. Install and tighten the four shutter retaining screws.
7. Install the front cover. Squeeze the sides of the cover just enough to engage the pivot points.

8. Close the front cover and check the camera.

L. FRESNEL ASSEMBLY DRIVE SYSTEM, REMOVE

The Fresnel assembly drive system controls the Fresnel assembly through its cycle from viewing position to exposure position and return. The system consists of two bell-crank assemblies, an actuator link, and the associated springs. These assemblies are mounted in such a way that the motor drive pinion shaft is also involved in the system functions. Faulty operation can result from broken springs, components, binding, distortion, or any of the malfunctions common to miniature mechanical devices. If a camera malfunction is traced to the Fresnel carrier drive assembly, removal and replacement can be accomplished according to the following procedures.

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera.
4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Slide the strip from one location stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Refer to Figure 4-35. Use tweezers and remove the two override springs.
9. By manually rotating the second idler gear in the counterclockwise direction, operate the gear-train until the Fresnel carrier swings up to the exposure position.
10. Refer to Figure 4-36. Use the tweezers to catch the end of the booster spring. Stretch the spring just enough to unhook the end of the spring.
11. Refer to Figure 4-37. Use tweezers and slip the hooked end of the Fresnel carrier drive spring off its retainer on the drag link bell crank.
12. Refer to Figure 4-38. Remove the gear-train-assembly mounting screws. Note that three are machine screws but the fourth is a self-tapping screw. Note its location for reference.
13. Invert the camera so that the outer plate (gear-train) is on the bottom.

    NOTE: Do not disturb the gear-train when performing the following steps.

14. Grasp the gear-train in such a manner that the front cover latch is depressed and pull the gear-train down and away from the camera. Immediately apply a rubber band lengthwise around the gear-train to hold the gears in place while performing the following steps.

    NOTE: At this point in the procedure, the gear-train is still fastened to the flex circuit. Be careful to avoid damage to the flex circuit.

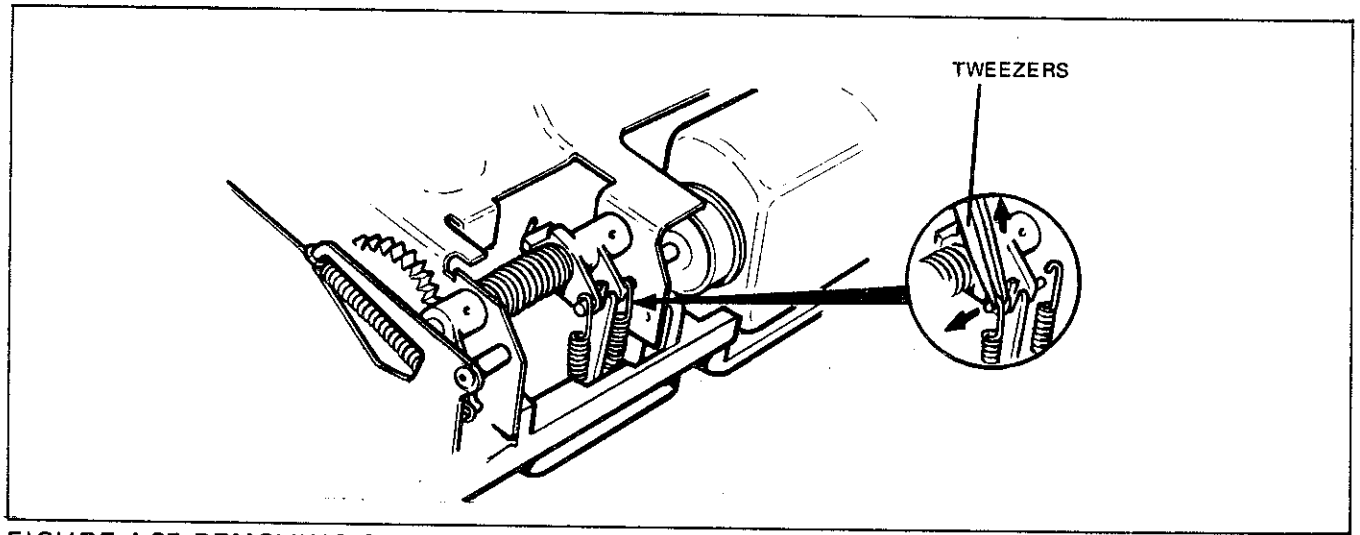

FIGURE 4-35 REMOVING OVERRIDE SPRINGS

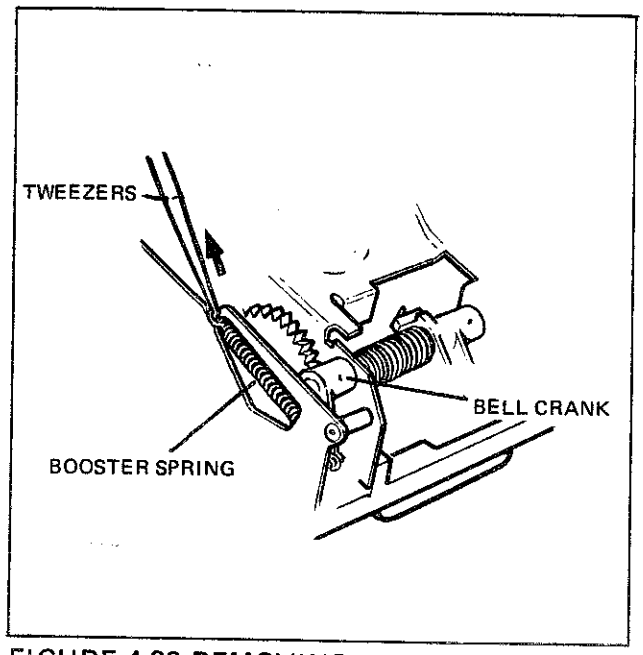

FIGURE 4-36 REMOVING BOOSTER SPRING

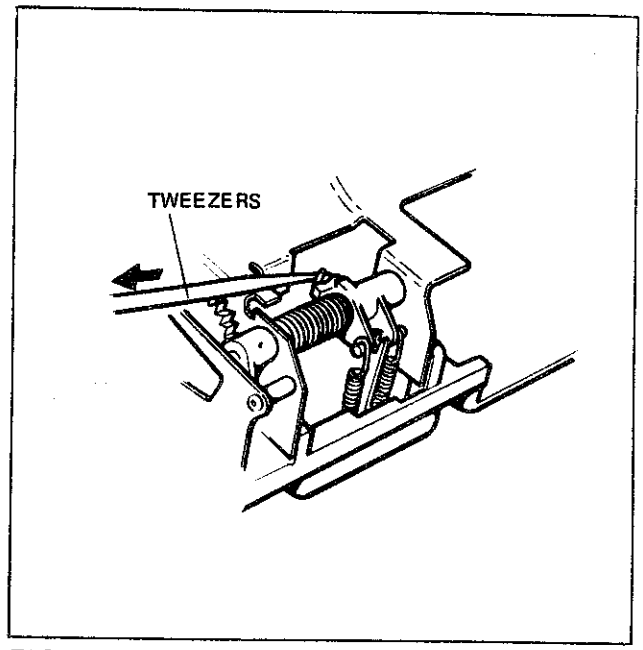

FIGURE 4-37 REMOVING FRESNEL CARRIER DRIVE SPRING

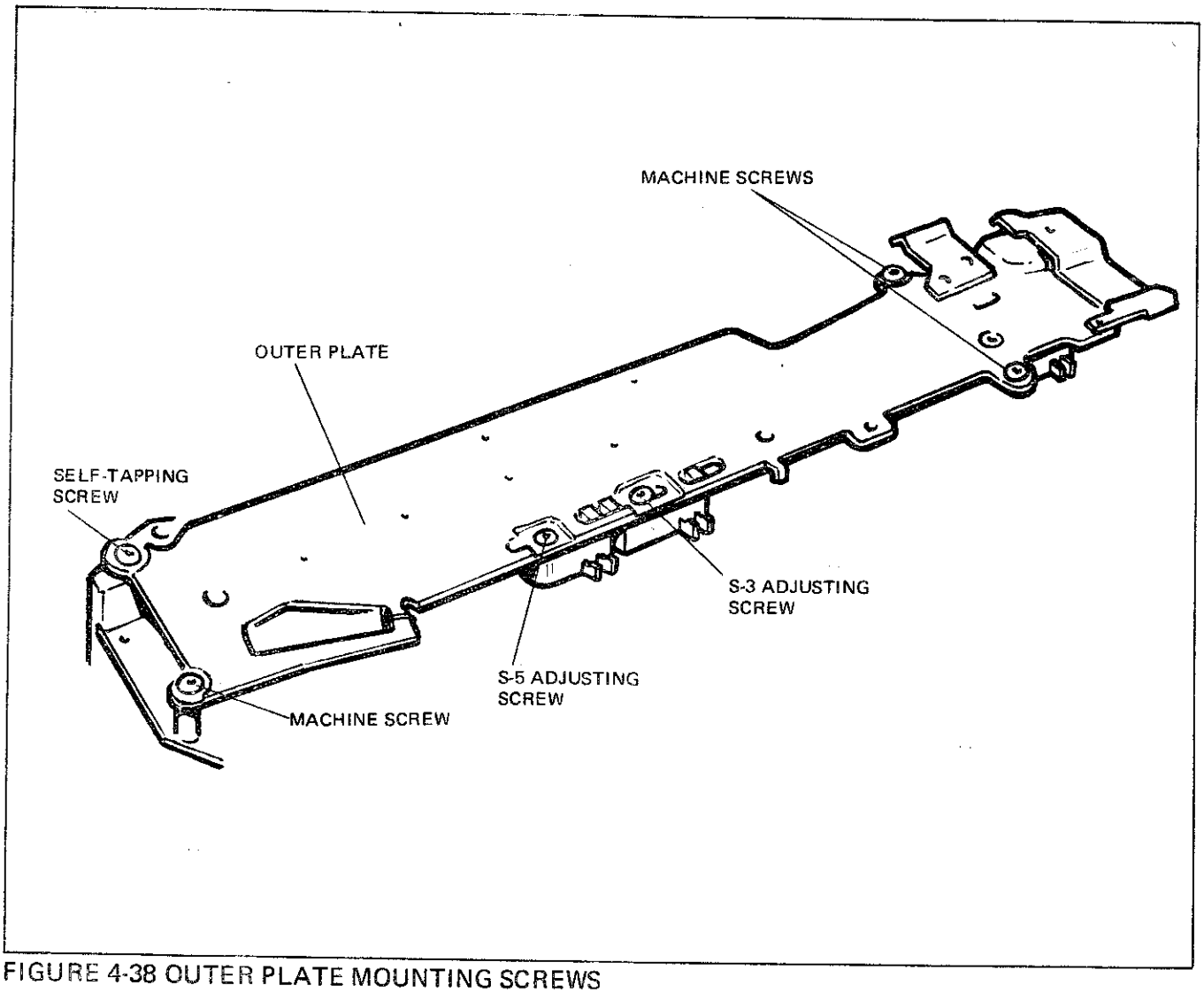

FIGURE 4-38 OUTER PLATE MOUNTING SCREWS

15. Grasp the recock-ram bell crank. Rotate the bell crank counterclockwise until it disengages the slot in the drag link.
16. Swing the drag link away from the bell crank.
17. Rotate the recock-ram bell crank counterclockwise approximately 180 degrees to provide access to the end of the drive pin.
18. Use miniature drift pin. Push out the drag-link bell crank pin.
19. Remove the bell crank and shaft. The drive spring will be released. The plastic sleeve will also be released.
20. Use a solder-removing tool and remove the solder from the flex circuit at each of the two motor contacts.
21. With tweezers and, if necessary, a soldering iron, lift the flex circuit from the motor contacts.
22. Using the Bristol screwdriver, loosen the two motor mount screws approximately 4 turns.
23. With tweezers, swing the motor mount clamps free of the motor housing.
24. Grasp the MCC holder with tweezers and, at the same time, raise the contact end of the motor up and withdraw the motor coupling spring from the plastic coupling.
25. Span the motor pinion shaft with tweezers and press the plastic coupling from the shaft.

M. FRESNEL ASSEMBLY DRIVE SYSTEM, INSTALL

1. To replace the drive system, begin by sliding the pinion shaft through its bushing just far enough to permit installation of the phenolic washer.
2. Use the retainer plier, Special Tool #11659. Spread the grip ring and pass the pinion shaft through the ring.
3. Press the drive pinion gear against the end of the bushing and hold it firmly against the bushing. Using the special tool, spread the grip ring and slide it as close to the other end of the bushing as the tool will permit. The tool is such that, when the pressure on the pinion is released, the clearance between the pinion and the bushing should be .003 to .005 inches. Check with a feeler gage, Special Tool #11678.
4. Use Special Tool #11707. Insert the plastic coupling into the tool so that the slot in the end of the coupling engages the tang in the tool.
5. Rotate the gear train so that the slot in the pinion shaft is visible.
6. With the special tool, start to press the coupling on the pinion shaft.
7. Recock the gear train in both directions while carefully pressing the bushing onto the shaft. When the slot in the shaft is felt to be engaging the tang of the coupling, apply finger pressure to the outer face of the pinion gear and, at the same time, press the coupling on as far as it will go.
8. Remove the tool.
9. Rotate the gear train so that the slot in the coupling is visible.
10. Using Special Gage #11708, insert the small tip of the gage into the slot of the coupling. The opposite end of the gage should meet the inner wall of the bottom plate. If the gage will not fit as described, first try to push the bushing on a little farther. If this cannot be accomplished, remove and examine the inside of the coupling for damage and replace the coupling if necessary.
11. Rotate the motor shaft so that the tang on the drive spring will mate with the slot in the coupling. Check the mounting clamps to see that they are swung aside to clear the motor mounts. Tip the motor to direct the end of the drive spring toward the coupling.
12. Engage the drive spring with the plastic coupling and lower the motor into place.
13. Swing the motor clamps into place and tighten the two screws.
14. Visually check the gap between the drive spring tang and the bottom of the slot in the plastic coupling. Grasp the motor shaft with tweezers and remove all end play in the direction of the pinion. At the same time, press on the outer surface of the pinion gear to remove the play in that direction. The gap dimension should be approximately equal to the diameter of the spring wire.
15. If the gap is too small or nonexistent, use the small end of Special Tool #11707 to apply pressure to the end of the motor shaft (the end opposite the drive end). While holding the motor shaft against the limit of its forward travel, work the spring onto the shaft with a jeweler's screwdriver. Move the spring only enough to provide the necessary clearance.
16. If there is too much space between the drive-spring tang and the bottom of the coupling slot, the spring must be moved towards the

coupling. Use the jeweler's screwdriver and carefully work the spring away from the motor housing until the gap requirement is satisfied.

17. Insert the MCC, together with its holder, into the mounting clip.
18. Use tweezers to install the flex circuit over the two motor contacts, and solder the contacts.
19. Pick up the bell crank shaft and insert the shaft through the hole in the bottom plate.
20. See Figure 4-39. Insert the plastic sleeve into the drive spring.
21. Align the sleeve (and spring) with the hole in the bottom plate. Insert the shaft into the sleeve. The end of the spring must engage the boss on the inside of the bottom plate.
22. Slide the shaft through the sleeve until the end of the shaft just begins to emerge from the end of the sleeve.
23. See Figure 4-39. Use tweezers to install the drag-link bell crank. The bell crank must be installed as shown on the illustration so that the bell crank will engage the slot in the drag link.
24. Push the shaft in until the bell crank is flush against the camera housing.
25. Rotate the recock-ram bell crank (on the outer side of the bottom plate) in the counterclockwise direction until the hole in the shaft is aligned with the holes in the drag-link bell crank. Hold the shaft in this position.
26. Use tweezers to insert the drive pin in the bell crank hole. Use needle-nose pliers. Press the pin into place.
27. Raise the camera and gear train assembly to eye level so that both mating surfaces can be observed. Engage the hole in the bell crank with the stud of the recock ram.
28. Slip the front cover latch over the shoulder of the brass standoff bushing (safety-latch pivot).
29. Hold the gear train and the camera body tightly together. **They must not be allowed to separate.** Rotate the two assemblies so that the gear train is uppermost.
30. Maintaining a steady pressure against the gear-train assembly, use a dental pick and relocate

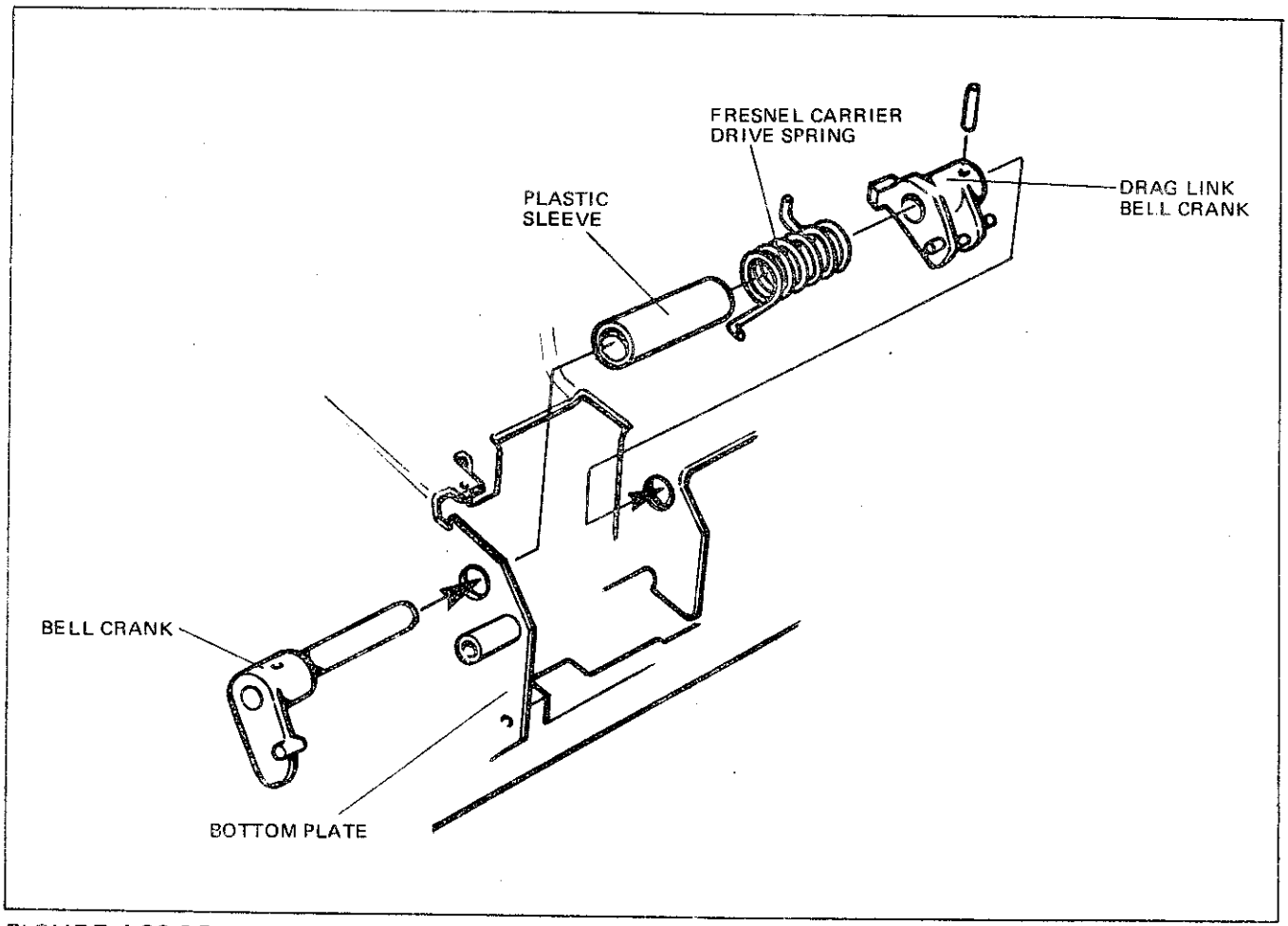

FIGURE 4-39 BELL CRANK ASSEMBLY

the pick-latch so that the pick-latch pivots drop into their pivot holes.

31. Using the dental pick, locate the safety cam actuator in the proper place on the second idler cam.
32. Gently rock the gear-train from side to side until all the gear posts fall corerctly into their pivot holes. When all pivots are correctly aligned, the plate will seat solidly and permit no further rocking action.
33. Refer to Figure 4-38. Install the three machine screws and the self-tapping screw to secure the gear-train assembly.
34. Cut and remove the rubber band. Tighten the screws.
35. Grasp the longer end of the override spring with needle-nose pliers.
36. With the open end of the hood down, slip the closed end of the spring over one of the arms of the T-shaped drag link and into the groove in the arm.
37. Hook the longer spring extension into the corresponding groove in the arm of the bell crank.
38. In the same manner, install the second spring.
39. Engage the hook on the end of the Fresnel carrier drive spring with the notched blade of the modified jeweler's screwdriver (Figure 4-40, step 1).
40. Tension the spring and hook it onto its retaining stud on the bell crank.
41. Obtain the Special Pulling Tool #11680. Feed the hooked end of the tool under the spring and engage it with the hooked end of the spring. (Figure 4-40, step 2).
42. Pull the end of the spring completely around giving the spring an additional full turn of tension.
43. Temporarily secure the end of the spring on the override spring mounting lug (Figure 4-40, step 3).

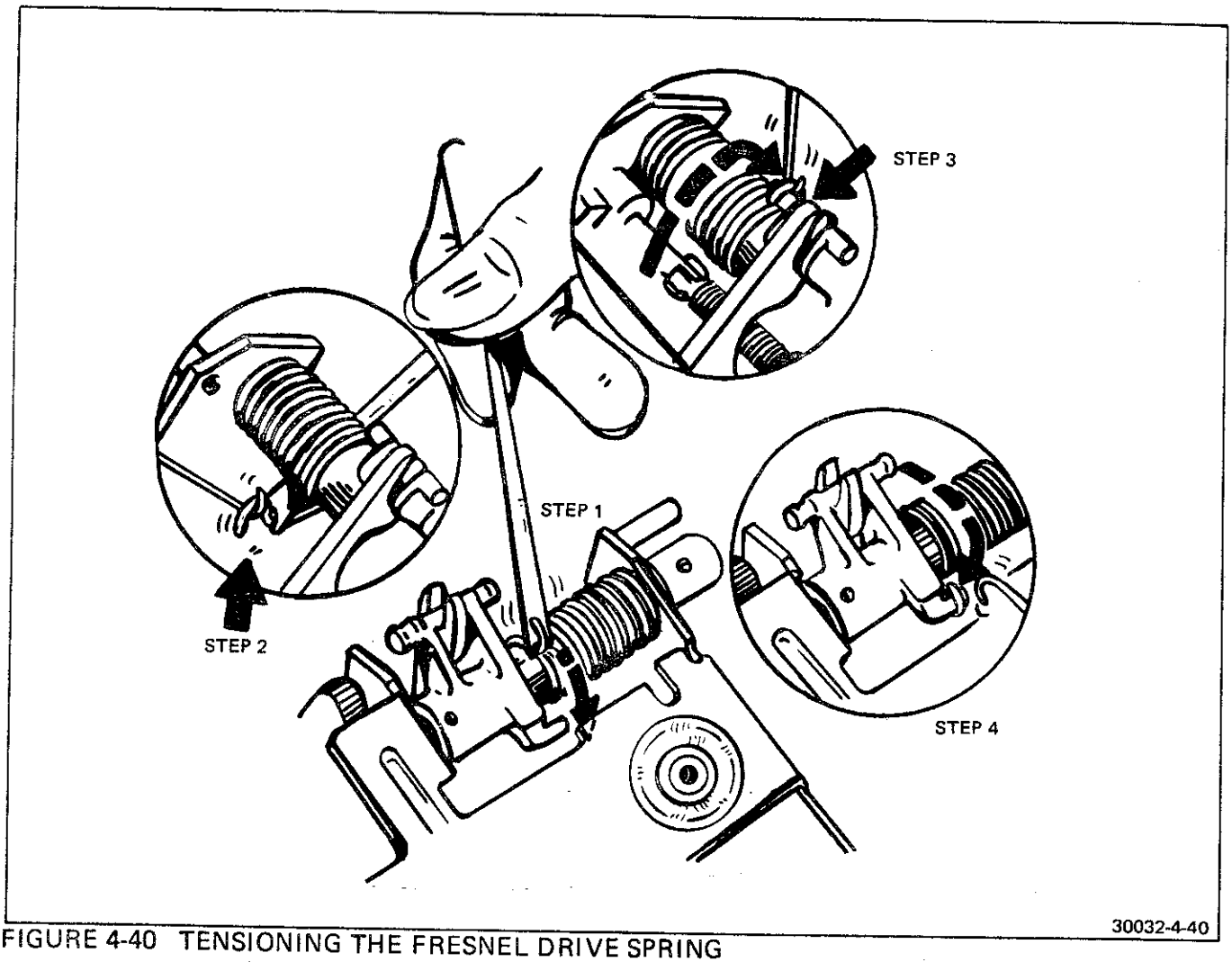

FIGURE 4-40 TENSIONING THE FRESNEL DRIVE SPRING

44. Put aside the pulling tool and, using the notched-blade screwdriver, push the end of the spring down and secure it on the bell-crank retaining stud (Figure 4-40, step 4).
45. Using the end of the screwdriver, slide the spring tightly against the bell crank.
46. Rotate the second reduction gear counterclockwise to actuate the gear train until the Fresnel carrier lifts to the exposure position.
47. The booster spring has one long hooked end. Hold the spring so that the open loop of the spring is toward the top of the camera. Slip the loop through the space provided and engage the loop on the stud of the bell crank.
48. Using Special Tool #11680, pull the other end of the spring down and fasten the hook of the spring on the anchor point.
49. Continue rotating the second reduction gear counterclockwise until the mirror returns to the viewing position.
50. Check the camera for proper operation.
51. Slide the bottom cover into place.
52. Install and tighten the four cover-retaining screws.
53. Squeeze the sides of the front cover just enough to engage the pivot points.
54. Close the camera and reinstall the leather on the bottom cover.
55. Check the camera.

N. FRESNEL CARRIER, REMOVE (includes Drive Pawl, Drag Link, and Light Stop)

The Fresnel carrier is the swinging mount for both the Fresnel screen and the exposure mirror. The surfaces of both the screen and the mirror are extremely delicate and are, thus, easily damaged. If the mirror surface or the Fresnel screen has been damaged or soiled, the quality of the pictures will be degraded. The Fresnel carrier must be replaced. One or both of the carrier hinges can be cracked or broken, or the light stop could be damaged, loose or misplaced due to automatic assembly. The location of the light stop is critical; if not precisely positioned, the camera will have an intermittent S3 mode function. Replace light stop, part no. 705801 in the correct location. See Figure 4-40A.

Both the drive pawl and the drag link are subject to wear during camera use and, since the Fresnel carrier must be removed to provide access to these two components, their removal and replacement procedures are included in these paragraphs.

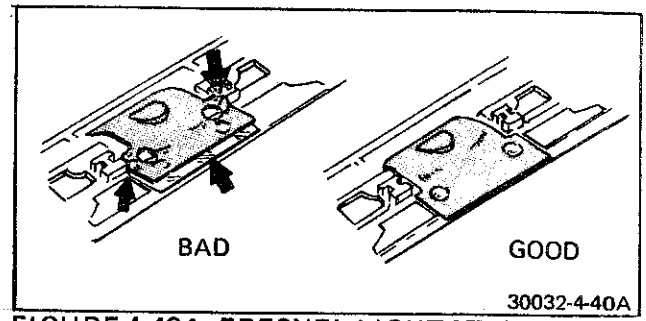

FIGURE 4-40A FRESNEL LIGHT STOP BINDING

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Lift the cover a small distance away from the camera, then slide the cover from the assembly.
8. Remove the inner-frame-to-boot-retainer screws. See Figure 4-41.

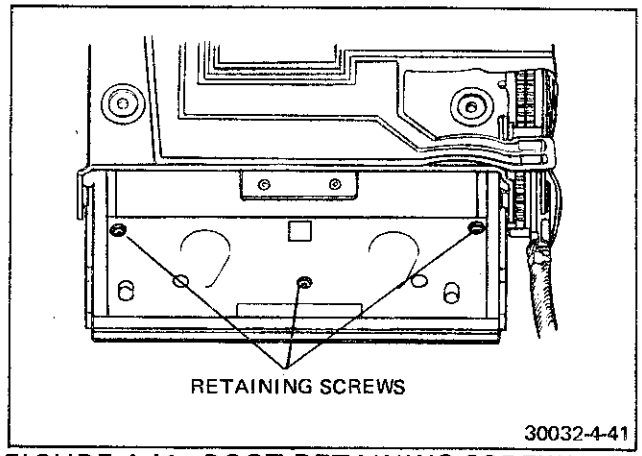

FIGURE 4-41 BOOT RETAINING SCREWS

9. Remove the mirror-cover-to-inner-frame hinge pins. Use Special Tool #11719.
10. Refer to paragraph A-13, use Special Tool #11698 and remove the boot. If the special tool is not available, proceed as follows:
11. Identify the second gear from the motor end of the gear train. Rotate this gear in the counterclockwise direction until the pick slide reaches the end of its travel and is captured by the pick-latch.
12. Refer to Figure 4-42. Use a narrow-blade jeweler's screwdriver. While pulling the corner of the mirror cover away from the frame, depress the boot retainer tab to clear the retaining stud. Release the pressure as soon as the tab snaps free.

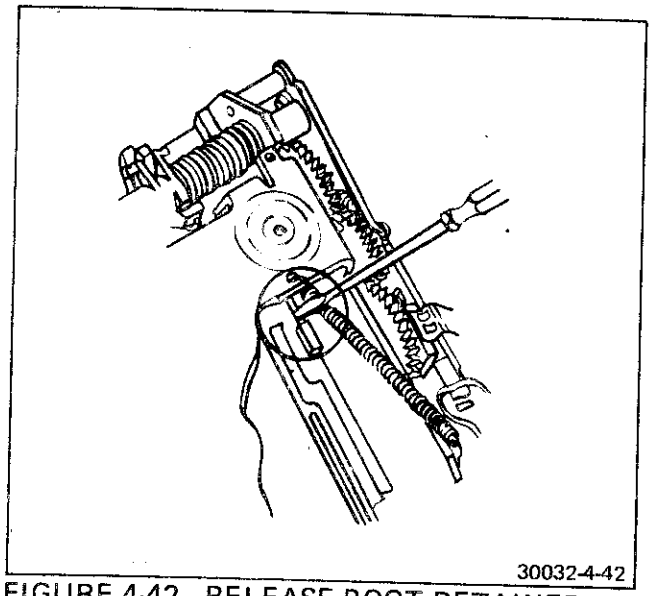

FIGURE 4-42 RELEASE BOOT RETAINER TAB

13. Rotate the gear further in the counterclockwise direction until the pick slide is released and snaps forward.
14. Use the jeweler's screwdriver and, while pulling the boot away from the frame, pry off the second tab.
15. Slide the erecting link to the end of its slot and disengage the link.
16. If desired, the light stop can be replaced at this time.
    a. Carefully peel off the old light stop.
    b. The replacement light stop is supplied with adhesive already applied. Remove the backing paper and press the light stop into contact with the Fresnel carrier. Avoid any creases or wrinkles as the material is applied.
17. Use tweezers and remove the two override springs. See Figure 4-43.
18. Using Special Tool #11719, press out the two Fresnel carrier hinge pins.
19. Release the safety latch and lift off the Fresnel carrier. If the carrier is to be reused, procure a protective sleeve and install it on the Fresnel carrier to prevent damage to the mirror or the Fresnel screen.
20. If it is desireable at this time to remove and replace the drag link, proceed as follows:
    a. Refer to Figure 4-44. Use a miniature drift pin or Special Tool #11662 and drive the pivot pin just far enough to clear the drag link.
    b. Place the replacement drag link into position.

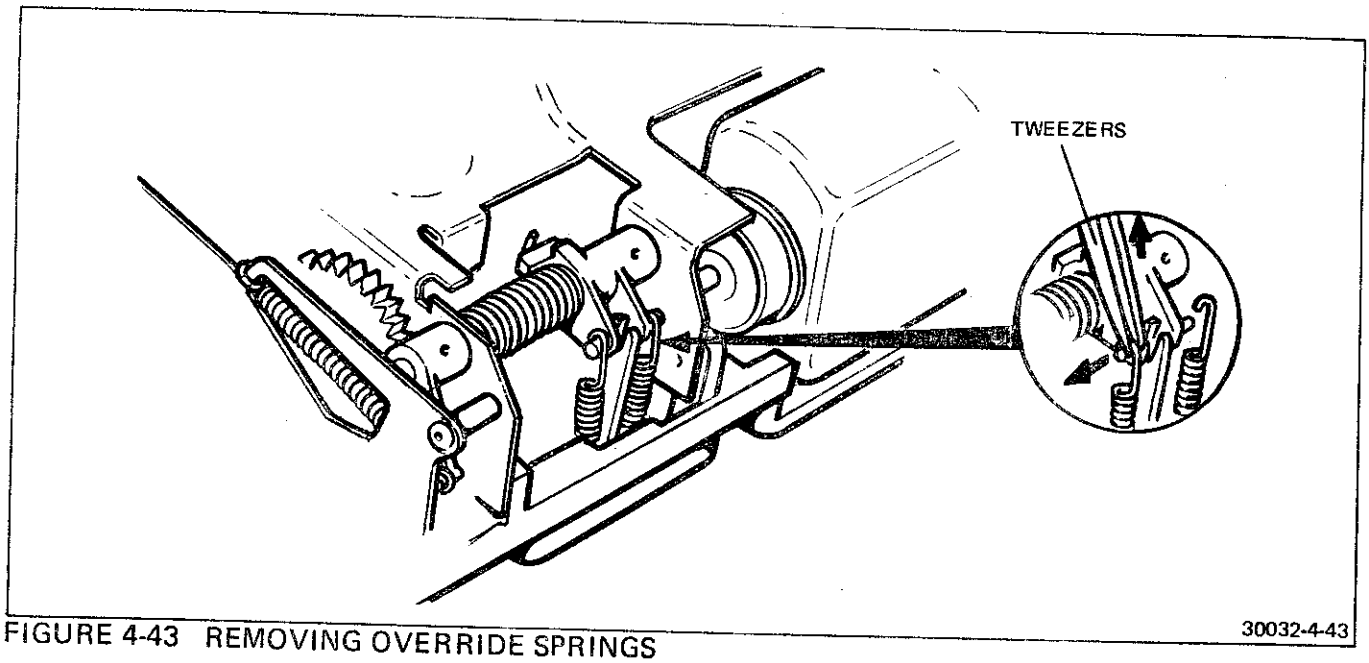

FIGURE 4-43 REMOVING OVERRIDE SPRINGS

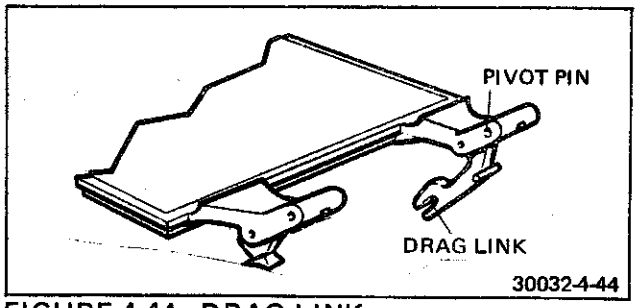

FIGURE 4-44 DRAG LINK

c. Use parallel-jaw pliers and press the pin into place so that the ends are flush with the casting.

21. If it is desireable at this time to remove and replace the drive pawl and its spring, proceed as follows:

a. Refer to Figure 4-44. Use tweezers and release the drive pawl spring.

b. Use a miniature drift pin and drive the pivot pin far enough to clear the drive pawl, Special Tool #11662.

c. Install the spring on the replacement drive pawl.

d. Set the pawl and its spring into position and drive in the pivot pin until its end is flush with the casting.

e. Engage the end of the spring in its slot in the pawl.

O. FRESNEL CARRIER, INSTALL

Caution: The new fresnel carrier operates *without* a safety latch, actuator or spring and requires a new drag link and override spring. Beginning with carrier, part number 705447, the changes outlined are mandatory. The safety latch must be removed. Its actuator and spring may be left in place providing that the spring tensions the actuator.

1. Hold the Fresnel carrier in such a position that the drag link hangs straight down.

2. When performing this step, be careful that the drag link does not disturb the position of the motor drive coupling spring on its shaft. Lower the Fresnel carrier in such a manner that the slot in the drag link will engage with the cross bar of the bell crank.

3. Lift the opposite corner of the Fresnel carrier just enough to gain access to the drive pawl tension spring. With the blade of a small screwdriver, engage the free end of the spring and push it back into the pawl cavity (applying tension to the spring) as far as possible, at the same time, lower the corner of the Fresnel carrier until the hinge-pin holes are aligned.

4. Press the hinge pin into place so that the end of the pin is flush with the surface of the casting.

5. In like manner, install the hinge pin on the drag-link side of the carrier.

6. Carefully depress the carrier by hand while examining the two hinge areas to make certain there is no interference or binding.

7. Remove the protective sleeving from the Fresnel carrier.

8. Check the safety latch to make sure that is has correctly captured the carrier.

9. Check the drag link. It should be engaged with the drag link bell crank. If not, use needle-nose pliers and engage the drag link.

10. With the needle-nose pliers grasp one of the override springs at its longer extension. Hook the smaller loop of the spring over one of the arms of the T-shaped drag link and into the groove in the arm.

11. Hook the longer spring extension into the corresponding groove in the arm of the bell crank.

12. In the same manner, install the second spring.

13. By rotating the second reduction gear in the counterclockwise direction, operate the gear train through one complete cycle to check proper operation of the system.

14. Insert the roller on the end of the erecting link into the hole at the end of the curved slot and slide the link into position.

15. Lower the mirror cover so that the free-hanging actuator passes through the cutout in the inner-frame assembly toward the S6 contacts.

16. Carefully lower the cover into place.

17. Snap the boot retainer into place by applying finger pressure to the two points indicated on Figure 4-45.

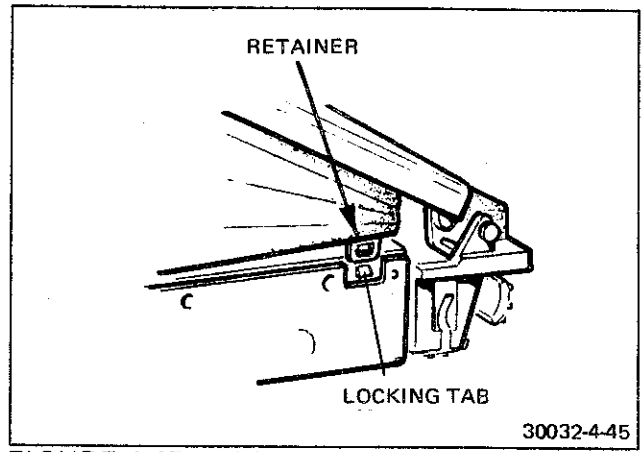

FIGURE 4-45 BOOT RETAINER

18. Reinstall the two mirror-cover-to-short-cover hinge pins.
19. Install and tighten the inner-frame-to-boot retainer screws.
20. Slide the bottom cover into place.
21. Install and tighten the four cover retaining screws.
22. Replace the decorative leather covering on the bottom cover.
23. Squeeze the sides of the front cover just enough to engage the pivot points.
24. Close the cover and check the camera.

P. LIGHT BAFFLE, REMOVE

The light baffle is included in the camera to eliminate unwanted light from reaching the film during the exposure portion of the operating cycle. If the baffle has been distorted or if it fails to function because of binding, broken spring, or other malfunction undesireable flare will appear on the pictures. The following paragraphs describe the procedure for removal and replacement of the baffle.

NOTE: It may **not** *be necessary to remove the baffle if the problem is caused by bent baffle ears (tabs). In this case, use the Special Tool #11773, baffle ear reforming tool, and do the following:*

1. Remove the front cover.

2. Make sure that the Fresnel carrier is down, in the viewing position.

3. Hold the camera bottom up and look inside the film compartment. The light baffle is visible toward the front edge of the film compartment.

4. Insert the tool with the slotted, right-angled end first, parallel to the bottom of the baffle.

5. Keep the long handle of the tool handle aligned with the side of the baffle and slide the end to the inside of the camera, thereby catching the baffle in the slot (Figure 4-46).

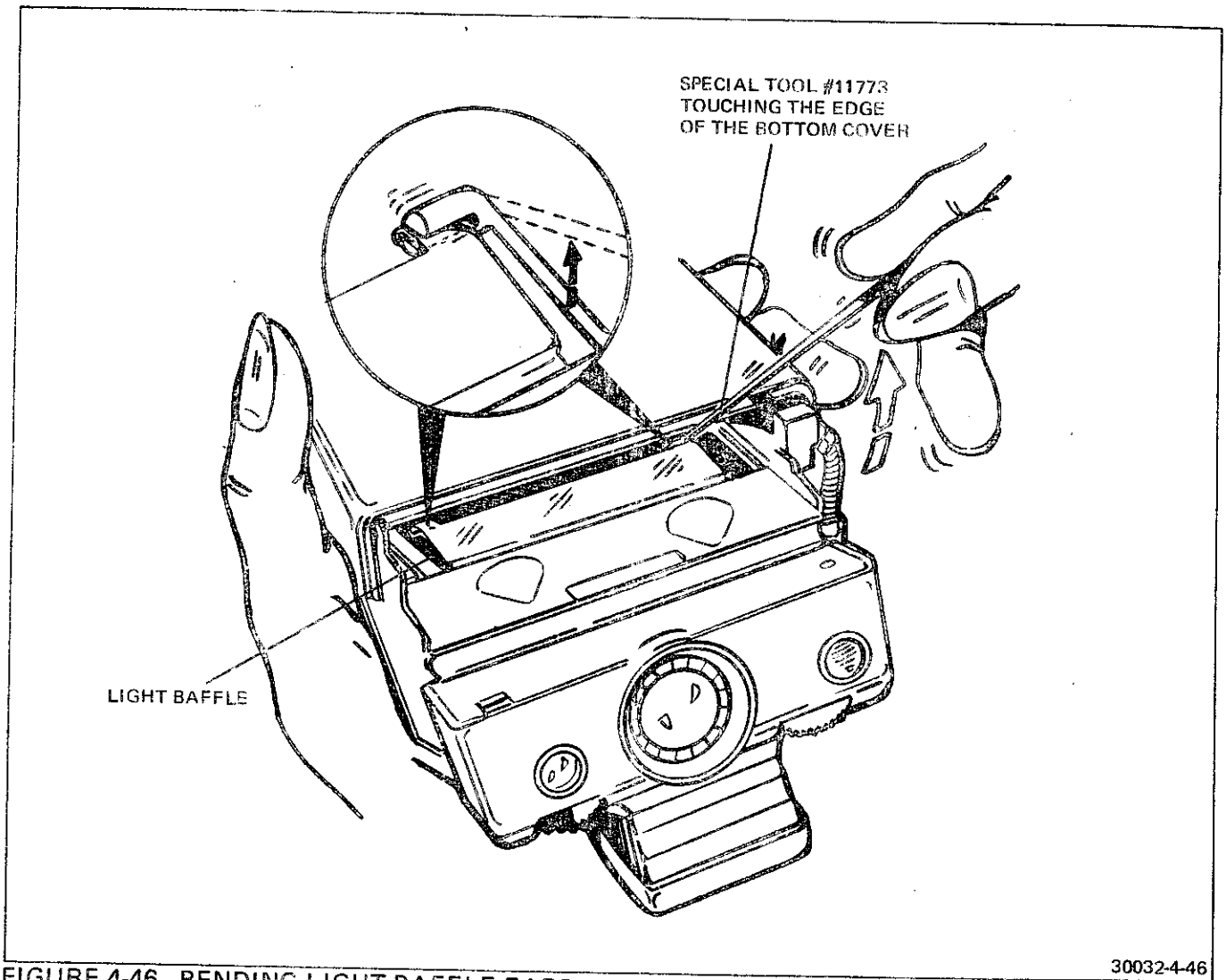

FIGURE 4-46 BENDING LIGHT BAFFLE EARS

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6. *Push the tool away from you, gently, until you feel the resistance caused by the curl at the end of the ears.*
7. *Once seated as described, push the handle end of the tool up just enough to touch the edge of the bottom cover.*
8. *Without putting angular stress on the baffle, slip the tool toward the outside of the camera and carefully remove.*
9. *Repeat the same process on the other side to be certain that both ears have the same correct bend.*
10. *Some light baffles may be received with oil on the surface. The oil will dirty the taking mirror producing a shadow on the bottom of the pictures. In this case, change the baffle and clean the dirty mirror with lens tissue and/or Q-tip moistened with lens cleaner. Also check whether oil has been deposited on the inner frame and, if found, remove.*

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward gear-train side of the camera. A very small amount of movement in this direction will force the pivot from its mount and allow the front cover to be removed.
4. Carefully peel the leather decorative covering from the bottom cover.
5. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
6. Slide the cover from the assembly.
7. Remove the inner-frame-to-boot retainer screws indicated in Figure 4-47.
8. Remove the two mirror-cover-to-inner-frame hinge pins. Use Special Tool #11719.
9. Use Special Tool #116982 and remove boot. See paragraph A-13. Identify the second gear from the motor end of the gear train. Rotate this gear in a counterclockwise direction until the pick slide reaches the end of its travel and is captured by the pick latch.

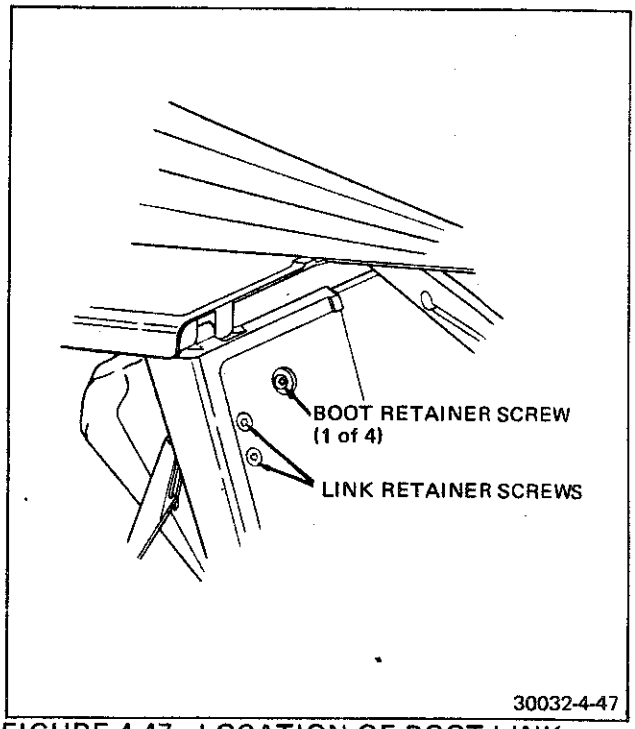

FIGURE 4-47 LOCATION OF BOOT LINK AND RETAINER SCREW

10. Refer to Figure 4-48. Use a narrow-blade jeweler's screwdriver. While pulling the corner of the mirror cover away from the frame, depress the boot retainer tab to clear the retaining stud. Release the pressure as soon as the tab snaps free.
11. Rotate the gear further in the counterclockwise direction until the pick slide is released and snaps forward.

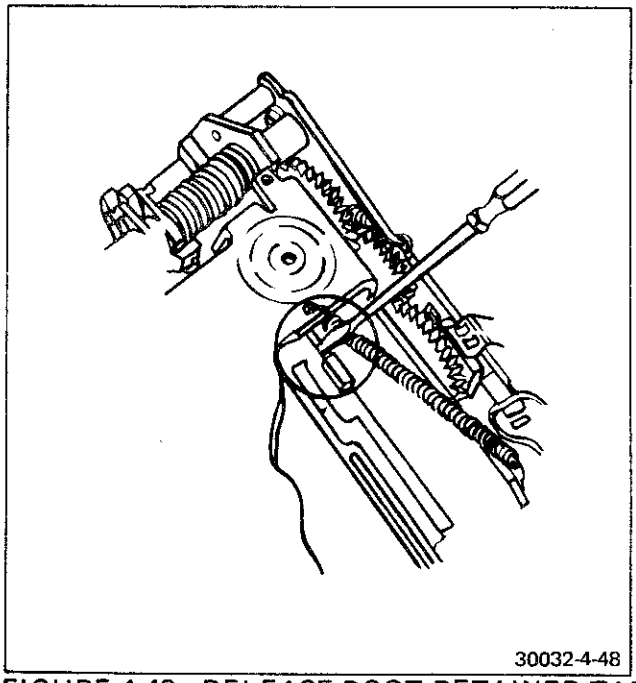

FIGURE 4-48 RELEASE BOOT RETAINER TAB

12. Use the jeweler's screwdriver and, while pulling the boot away from the frame, pry off the second tab.
13. Slide the erecting link to the end of its slot and disengage the link.
14. Swing the entire upper camera back to one side. Use care to avoid damage to the ribbon cable.
15. Rotate the gear train in the counterclockwise direction until the Fresnel carrier swings up into the exposure-mode position.
16. Use duck-bill or needle-nose pliers. Grasp light baffle hinge pin and bend it to a 90° angle. See Figure 4-49. Use a small peen hammer and knock the pins inboard striking the tool holding the bent end of the pin. Remove left-hand (viewed from rear) pin first. Remove spring and lite baffle by sliding off the right-hand pin.
17. Lift out the baffle.

Q. LIGHT BAFFLE, INSTALL

1. Obtain the replacement baffle.
2. Place the baffle in position.
3. Using tweezers or needle-nose pliers, insert the end of the pin into the hinge holes from the center of the camera.
4. Install baffle with spring on right hand pin. Use pliers with one jaw on the outside of the hinge post and squeeze the pin outwards until it reaches the stop (Figure 4-50). Check the spring action of the baffle. It must be completely free – no evidence of binding is tolerable.
5. Refer to Figure 4-51. Install the spring on the right-hinge pin.
6. Engage the shorter of the two spring extensions into the slot on the lip of the baffle.

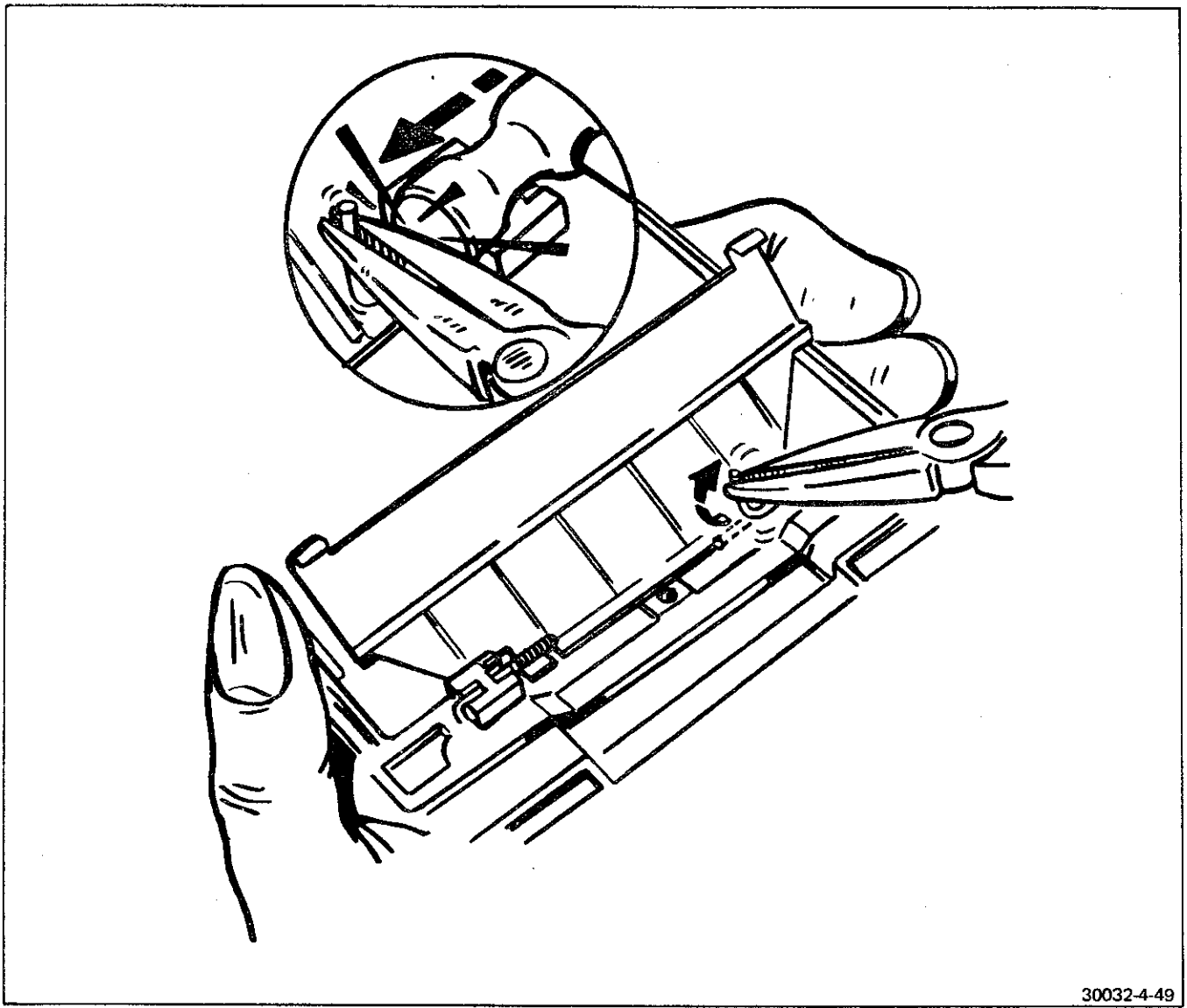

FIGURE 4-49 REMOVING LIGHT BAFFLE HINGE PIN

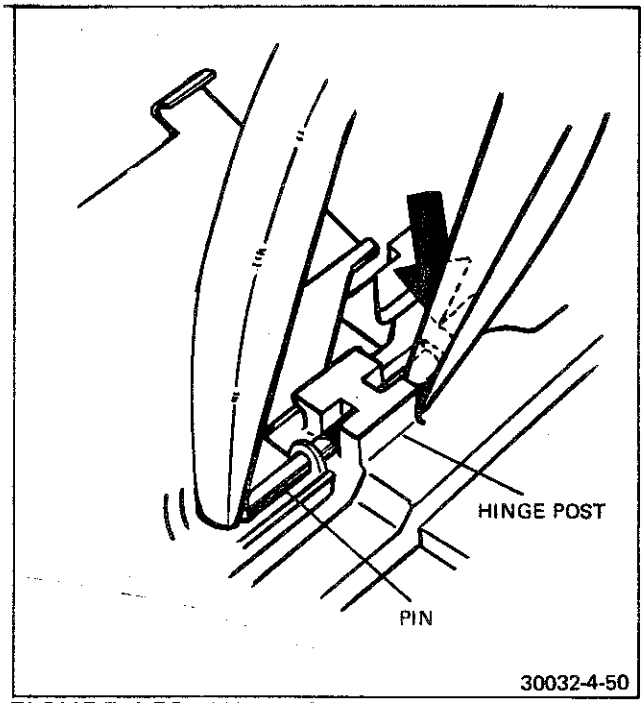

FIGURE 4-50 USING PLIERS TO INSERT LIGHT BAFFLE HINGE PIN

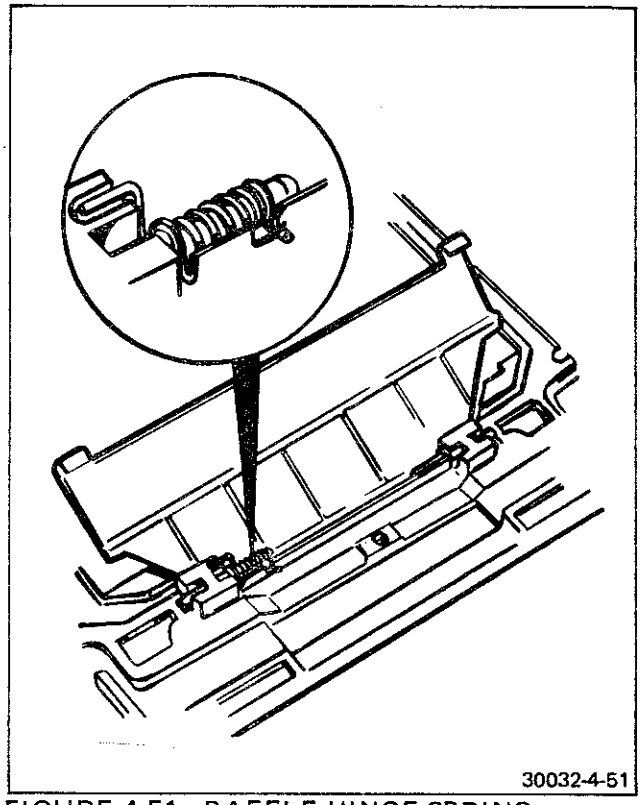

FIGURE 4-51 BAFFLE HINGE SPRING

7. Use a dental pick or other suitable tool and hook the longer spring extension into the slot provided for it on the inner frame.
8. Remove the protective sleeve from the Fresnel carrier.
9. Manually operate the gear train to lower and latch the Fresnel carrier.
10. Swing the upper back assembly back into normal position, and install the shutter bracket pivot pins.
11. Insert the roller of the erecting link into its slot.
12. Hold the cover assembly in such a position that the S6 actuator hangs straight down.
13. Lower the housing so that the free-hanging actuator passes through the cutout in the inner frame assembly toward the S6 contacts. See Figure 4-52.

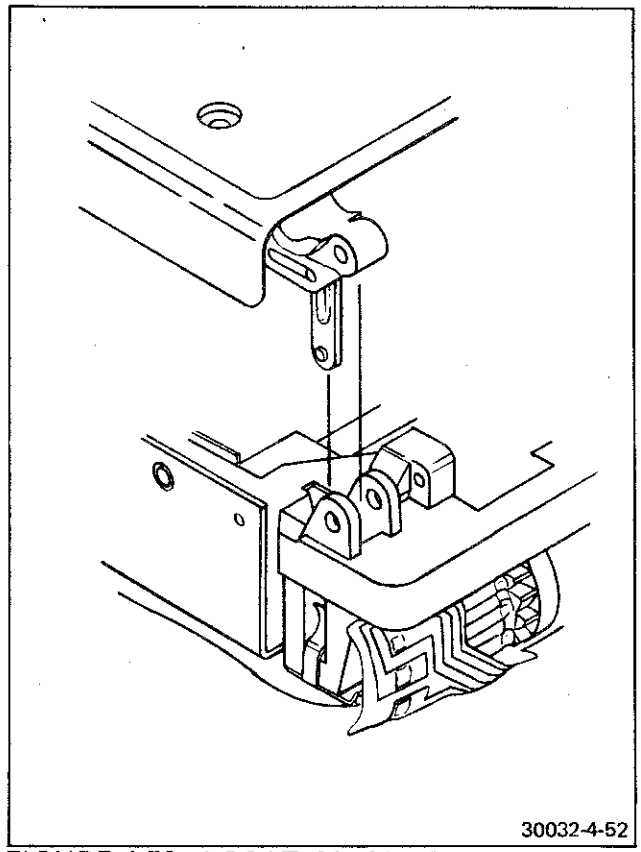

FIGURE 4-52 LOCATION OF S6 ACTUATOR LINK

14. Snap the boot retainer over the tabs on the inner frame.
15. Reinstall the two mirror-cover-to-frame hinge pins.
16. Identify the second gear from the motor end of the gear train. Rotate this gear in a counterclockwise direction until the mirror is in the exposure position.
17. Install and tighten the inner-frame-to-boot retainer screws.
18. Install the gear-train cover.

19. Reinstall the bottom cover. Install and tighten the four screws.
20. Replace the front cover by squeezing the sides of the cover just enough to engage the pivot points.
21. Check the camera for proper orientation.
22. Replace the decorative leather covering on the bottom cover.

R. INNER FRAME, REMOVE

The inner frame assembly is located within the bottom plate assembly and is not frequently subjected to damage in normal camera use. It can be inadvertently damaged when other repairs to the camera are being performed and it can conceivably be damaged from severe shock. Its removal and replacement is a time consuming procedure and, for this reason, it will not be replaced unless the frame itself is damaged. The following paragraphs describe the removal/replacement procedure.

NOTE: To repair inner-frame-mirror-cover hinge, proceed as follows:

If either side hinge is broken, it is usually the outer hinge.

If the broken part of hinge is available, use 5 minute epoxy and apply to both sides of the break. Use very little epoxy and allow about 3 minutes to become tacky. Then stick the two pieces together. After drying, apply small amount of epoxy over the break and allow to follow the radius on the bottom (Figure 4-53). If the pin becomes glued to the black repaired hinge, no harm will be done since the chrome plated hinge attached to the mirror cover assembly rides around the pin.

Caution: **Do not allow any epoxy to attach itself to the chrome plated hinge. Allow overnight to become permanently attached and follow with a thorough test.**

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Remove the decorative leather covering from the bottom cover.

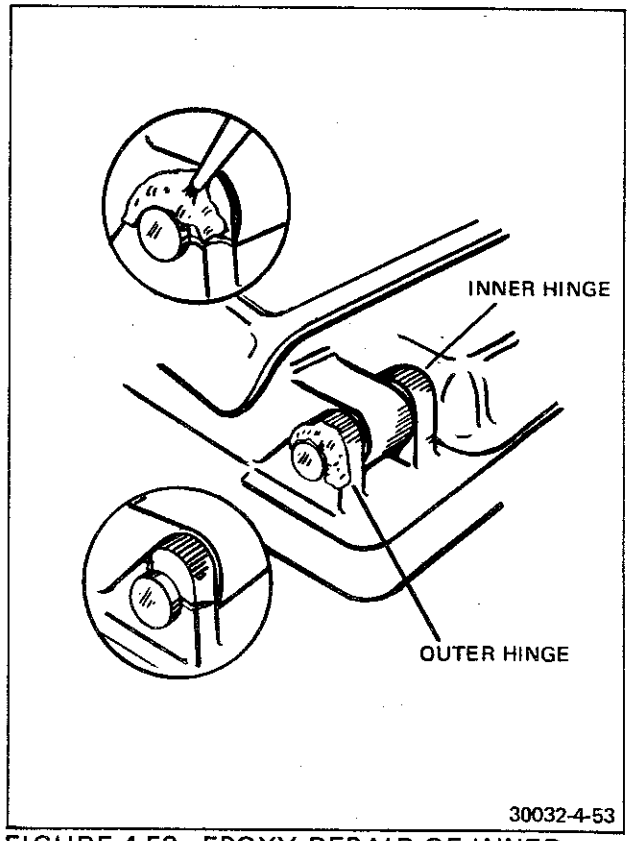

FIGURE 4-53 EPOXY REPAIR OF INNER FRAME HINGE

5. Remove the four bottom-cover retaining screws (Figure 4-54).
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Remove the inner-frame-to-boot-retainer screws.
9. Remove the mirror-cover-to-inner-frame hinge pins.
10. Referring to Figure 4-55, note the orientation of the handle – this must be as shown to prevent damage to the tool and/or the camera. Insert the Special Tool #11698 into the film compartment of the camera. See that the plunger handle is out away from the body of the tool. Be sure the tool is fully seated in the film compartment.
11. Firmly push the boot remover handle in to free the boot from the inner frame tabs. Push until a click is heard and the tool bottoms.

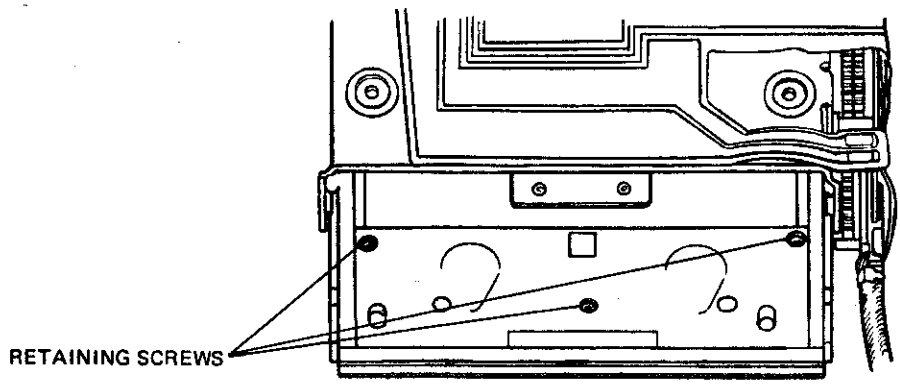

FIGURE 4-54 BOOT RETAINING SCREWS

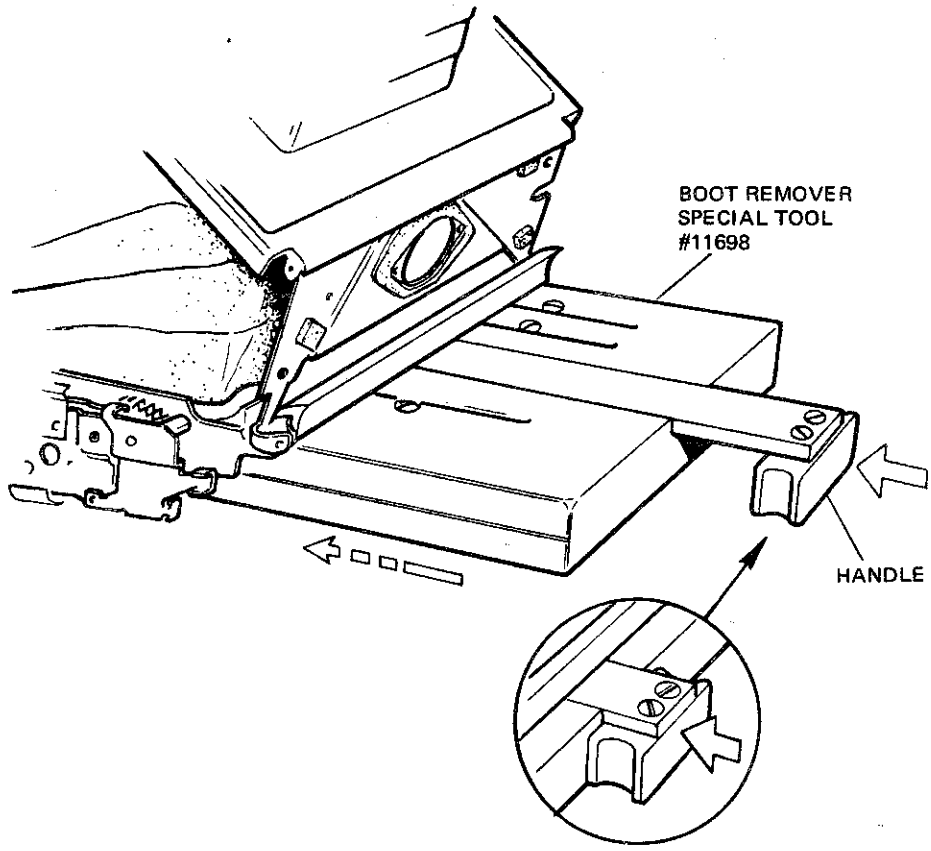

FIGURE 4-55 BOOT REMOVAL TOOL

12. Grasp the boot and gently pull up, first one side and then the other away from the tabs.
13. Pull the handle out and remove the tool.
14. Slide the erecting link to the end of its slot and disengage the link. Remove boot, complete with erecting link connected, being careful not scratch the Fresnel surface.
15. Identify the second gear from the motor end of the gear train. Rotate this gear in the counterclockwise direction until the pick slide reaches the end of its travel and is captured by the pick-latch.
16. Refer to Figure 4-56. Use a narrow-blade jeweler's screwdriver. While pulling the corner of the mirror cover away from the frame, depress the boot retainer tab to clear the retaining stud. Release the pressure as soon as the tab snaps free.

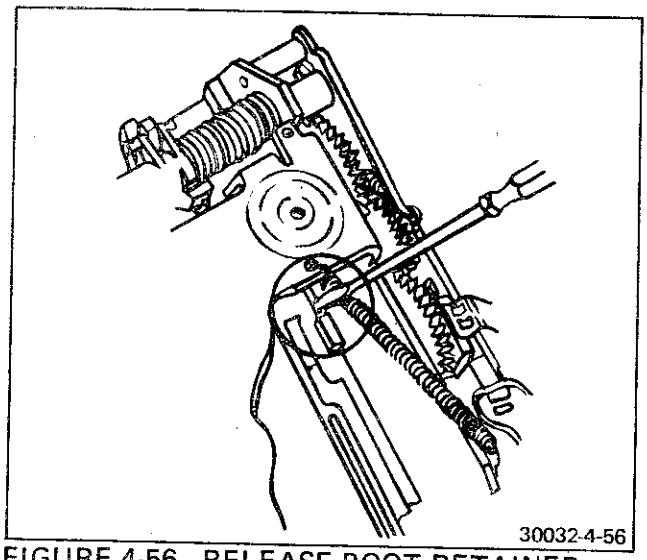

FIGURE 4-56 RELEASE BOOT RETAINER

17. Rotate the gear further in the counterclockwise direction until the pick slide is released and snaps forward.
18. Use the jeweler's screwdriver and while pulling the boot away from the frame, pry off the second tab.
19. Slide the erecting link to the end of its slot and disengage the link.
20. Swing the upper camera back away from the Fresnel screen.
21. Remove the four screws which secure the shutter assembly to the shutter mounting hinge bracket.
22. Remove the two hinge-to-boot retainer screws located adjacent to the round lens opening in the shutter hinge bracket.
23. With a jeweler's screwdriver, spring the pivots at the ends of the shutter mounting bracket and remove the bracket.
24. Squeeze the sides of the front cover just enough to engage the pivot points.
25. Close the front cover, lay the shutter assembly in the cover and secure with a rubber band.
26. Use tweezers and remove the two override springs. See Figure 4-57.
27. Using Special Tool #116604, press out the two Fresnel carrier hinge pins.
28. While pushing the safety latch forward, lift off the Fresnel carrier.
29. If the carrier is to be reused, procure and install a protective sleeve to prevent damage to the mirror or the Fresnel screen.

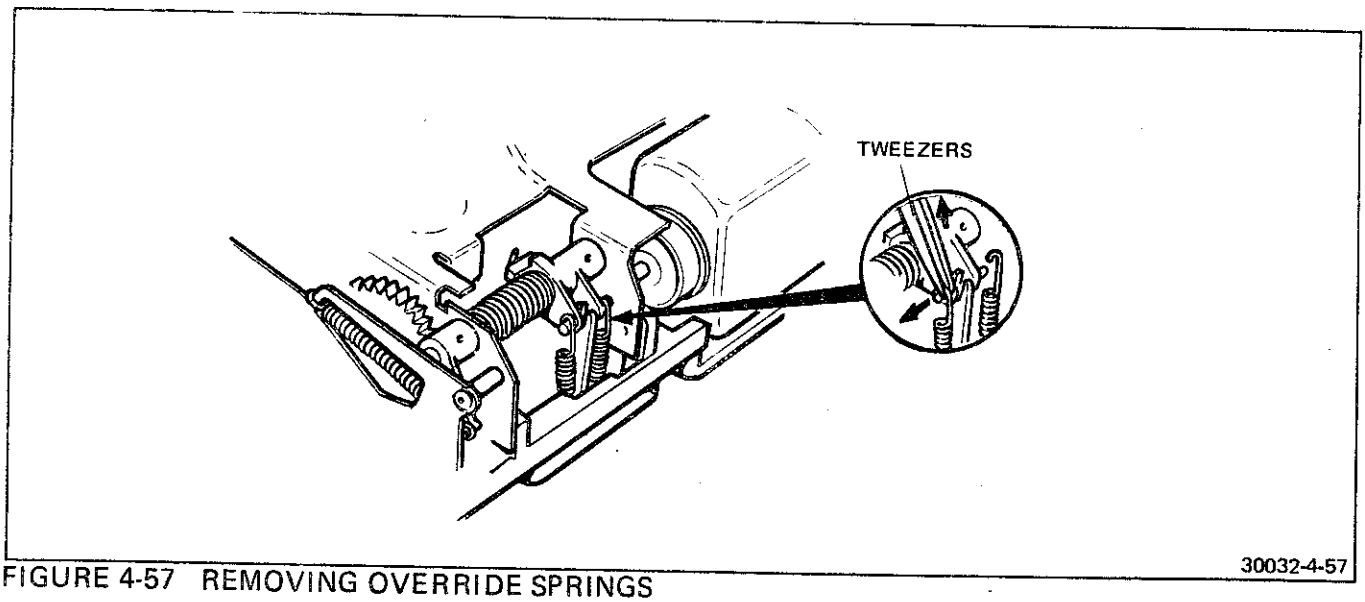

FIGURE 4-57 REMOVING OVERRIDE SPRINGS

30. Unsolder and disconnect the flex circuit from the two motor contacts.
31. Unsolder and disconnect the flex circuit from the S6 switch contacts.
32. Unsolder and disconnect the flex circuit from the three contacts.
33. Using tweezers, slide the MCC holder out of its mounting clip.
34. Carefully roll back the flex circuit just enough to provide access to the counter retaining screws.
35. Remove the two screws which secure the counter assembly to the inner frame. See Figure 4-58.
36. Grasp the MCC mounting clip with tweezers and lift out the counter.
37. Carefully roll back the flex circuit just enough to provide access to the motor retaining screws.
38. The motor is secured in place by two curved clamps that partially encircle the motor bearing housings. Each clamp is secured by a single screw. Remove the two screws and the two clamps.
39. Slowly lift out the end of the motor that includes the two electrical contacts. The coupling spring is sufficiently flexible to sustain a relatively sharp radius bend without damage.
40. Carefully withdraw the motor so that the coupling spring slips from the motor pinion shaft.
41. Remove the motor and coupling spring.
42. There are four screws securing the gear-train assembly to the bottom plate. Identify the screw that is nearest to the hinge-pin hole. Remove only this one screw.
43. Use a soldering iron suitable for melting plastic. Identify the five plastic studs on the frame side opposite the gear train. Using the iron, melt and push in each of the five studs. Open the front cover slightly to expose the fifth stud.
44. In like manner, melt the stud located adjacent to the gear-train drive pinion on the opposite side of the frame, and the seventh stud under the corner of the front cover.
45. Insert the blade of a screwdriver between the inner frame and the bottom plate assembly at each of the five stud positions (not at the stud adjacent to the pinion) and pry just sufficiently to release the melted stud from its mounting hole.

    NOTE: When performing the following step, the safety latch will drop off the inner frame. Be sure to retrieve the latch and retain it for future use with the replacement frame.

46. Withdraw the inner frame from the bottom plate assembly.

S. INNER FRAME, INSTALL

NOTE: See Introduction for method of repairing stripped screwholes.

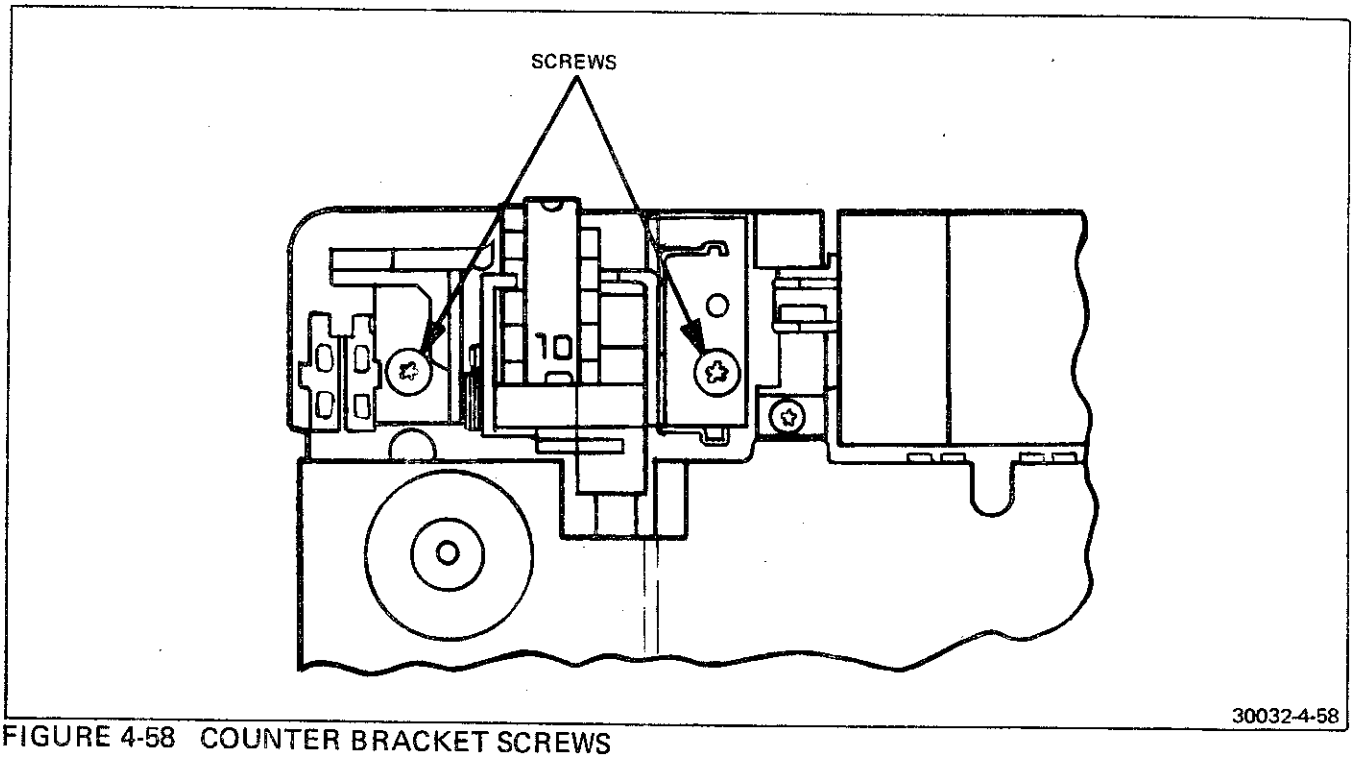

FIGURE 4-58 COUNTER BRACKET SCREWS

1. The replacement inner frame will be equipped with the S6 contacts and the spring-loaded light baffle installed. Thus, it is not necessary to remove these components from the damaged inner frame.
2. Before proceeding with the installment of the replacement inner frame, install the two motor clamps on the frame. Do not tighten. Leave the clamps loose enough to rotate.
3. Obtain a loading decal plate.
4. The colored side of the plate faces the opening of the inner frame. Place the plate in position over its two mounting studs.
5. Using the plastic-melting iron, heat the two studs to stake the loading decal plate in position.
6. Before proceeding with the installation, locate the slot of the safety latch actuator behind its slot in the bottom plate assembly. Remember the location of this slot (see Figure 4-59) since the inner frame will cover its position when it is installed.

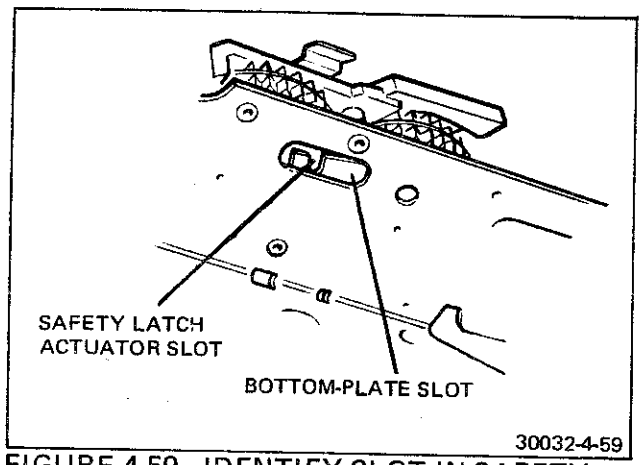

FIGURE 4-59 IDENTIFY SLOT IN SAFETY LATCH ACTUATOR

7. Position the inner frame so that the studs on the gear-train side of the frame will mate with the holes in the bottom plate assembly.
8. As the inner frame is lowered into contact with the bottom plate, observe the end of the loading decal plate must be positioned between the upright tab on the bottom plate and the bell crank drive spring. Bend the decal plate slightly if necessary.
9. Obtain the safety latch. Refer to Figure 4-59 and place the latch into position on the rim of the inner frame so that the longer of its two tabs engages the slot in the actuator. This operation must be performed by feeling for the actuator slot with the latch since the slot is not visible with the inner frame in place. Make sure that the latch is engaged in the actuator slot.
10. Use a thin screwdriver blade to spring the inner frame into place. Insert the blade between the inner frame and the bottom plate assembly and pry the plate just enough to clear the studs on the inner frame. Press the frame into place so that the studs snap into the five holes in the plate.
11. Check to see that the safety latch actuator spring is properly in place.
12. By rotating the second gear in the train in the counterclockwise direction, rotate the gear train through a complete cycle to see that the safety latch performs correctly.
13. Locate the inner-frame stud adjacent to the motor drive pinion and, using the staking iron, melt the head of the stud.
14. In the same manner, heat-stake the five studs on the side opposite the gear train.
15. Heat-stake the stud adjacent to the end of the gear train.
16. Reinstall the single gear-train securing screw.
17. Before installing the motor, it is imperative that the coupling spring position be critically checked. Use the motor gage (Special Tool #11679). Place the gage as shown on Figure 4-60. Press firmly on the end of the gage to remove all end play. If the end diameter of the spring tang is not flush with the top of the gage, adjust the spring accordingly.

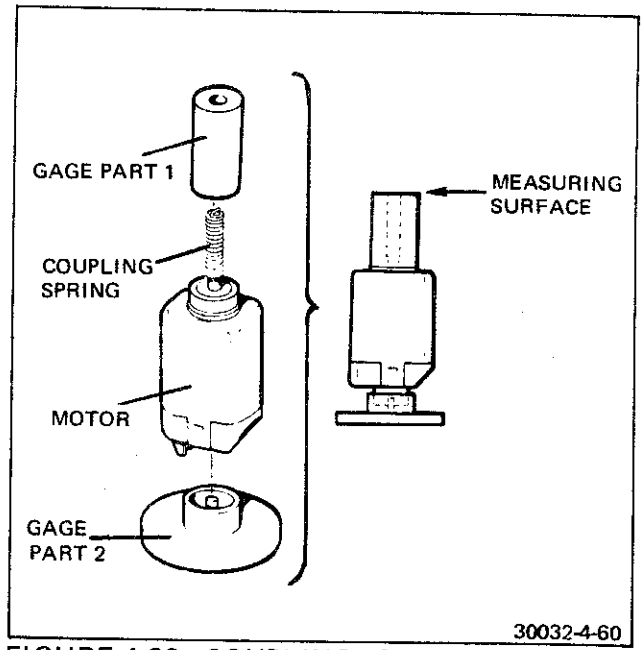

FIGURE 4-60 COUPLING SPRING GAGE

18. Refer to Figure 4-61. Hold the motor as shown. The motor pinion shaft can be rotated by manually operating the gear train. Rotate the shaft so that the cross tang on the coupling spring will correctly align with the slot in the plastic coupling.

19. Slide the coupling spring onto the plastic coupling as the motor is placed into position.

20. Rotate the two motor mounting clamps out of the way and seat the two motor shock mounts into the semi-circular mounting sockets in the inner frame. Note that the right motor shock mount is of larger diameter than the left.

21. Rotate the two clamps into position and tighten the two screws.

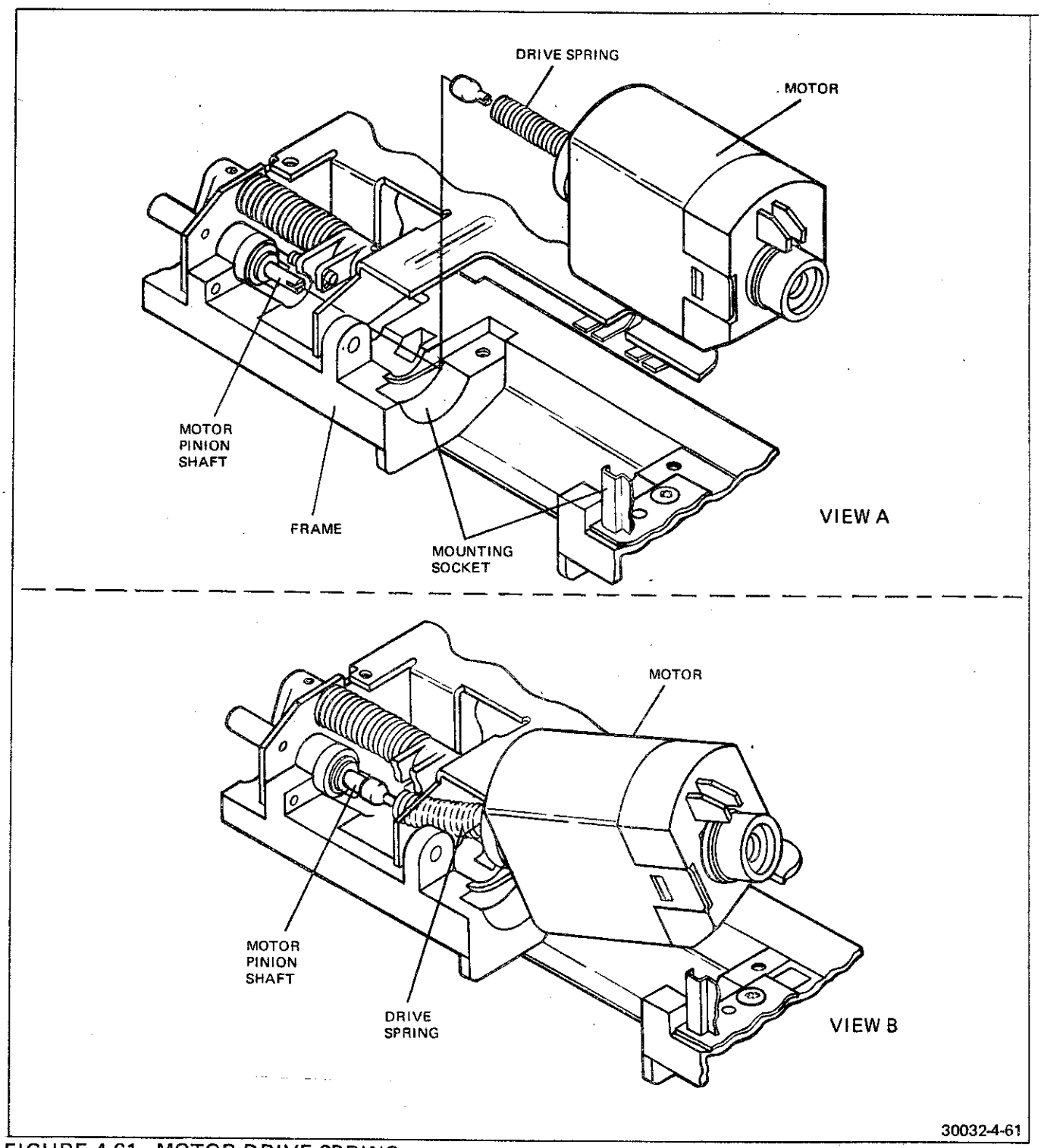

FIGURE 4-61 MOTOR DRIVE SPRING

22. The motor can be rotated very slightly in its clamps. Examine the installation carefully and rock the motor slightly in its mountings to make sure the motor is properly seated. Recheck and, if necessary, retighten the mounting screws.

23. Manually rotate the gear train so that the slot in the shaft can be seen.

24. Grasp the pinion shaft with tweezers and move the shaft toward the motor as far as the end play will permit.

25. Release the pinion shaft and grasp the motor shaft between the end of the coupling spring and the motor mount.

26. Visually check the gap between the drive-spring tang and the bottom of the slot in the plastic coupling. Grasp the motor shaft with tweezers and remove all end play in the direction of the pinion. At the same time, apply pressure to the outer surface of the pinion gear to remove the play in that direction. The gap dimension should be approximately equal to the diameter of the spring wire.

27. If the gap is too small or nonexistent, use the small end of Special Tool #11707 to apply pressure to the end of the motor shaft (the end opposite the drive end). While holding the motor shaft against the limit of its forward travel, work the spring onto the shaft with a jeweler's screwdriver. Move the spring only enough to provide the necessary clearance.

28. If there is too much space between the drive-spring tang and the bottom of the coupling slot, the spring must be moved toward the coupling. Use the jeweler's screwdriver and carefully work the spring away from the motor housing until the gap requirement is satisfied.

29. Before reinstalling the counter, the two pawls must be correctly positioned. Insert a dummy film pack into the film chamber to compress the pawl springs.

30. Identify the drive pawl, Figure 4-62. Use a thin flexible strip (such as a flexible steel pocket scale) and rotate the drive pawl so that it enters the cavity in the inner frame. Hold the pawl in this position.

31. Identify the reset pawl, Figure 4-63. A narrow groove can be found across the end of the reset pawl. Place this groove over the end of the reset-pawl spring and move the counter assembly into place. The counter assembly mounting bracket is provided with four holes; two for the locating pins and two for the mounting screws. The shape and size of the counter is such that only the locating holes will mate with the locating pins.

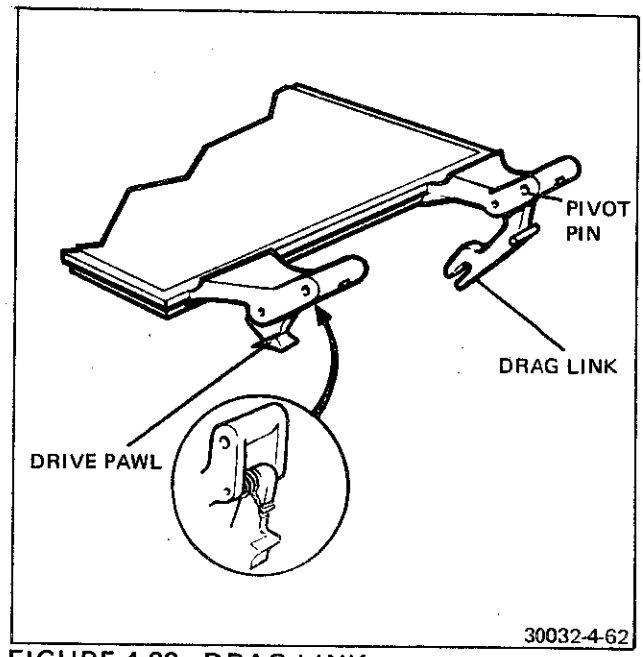

FIGURE 4-62 DRAG LINK

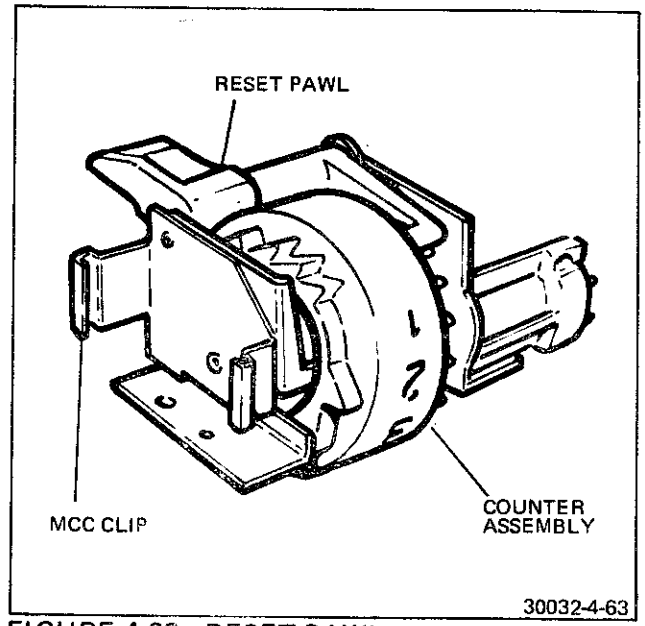

FIGURE 4-63 RESET PAWL

32. Bring the locating holes as close to the pins as the shim (pocket scale) will permit, then simultaneously slide out the shim and drop the counter over the locating pins.

33. Install and tighten the two mounting screws.

34. Check the operation of the counter. Manually rotate the counter to number 0 on the counter dial. Remove and then reinsert the dummy film pack. The counter should return to its starting position. If it does not, snap rapidly back to

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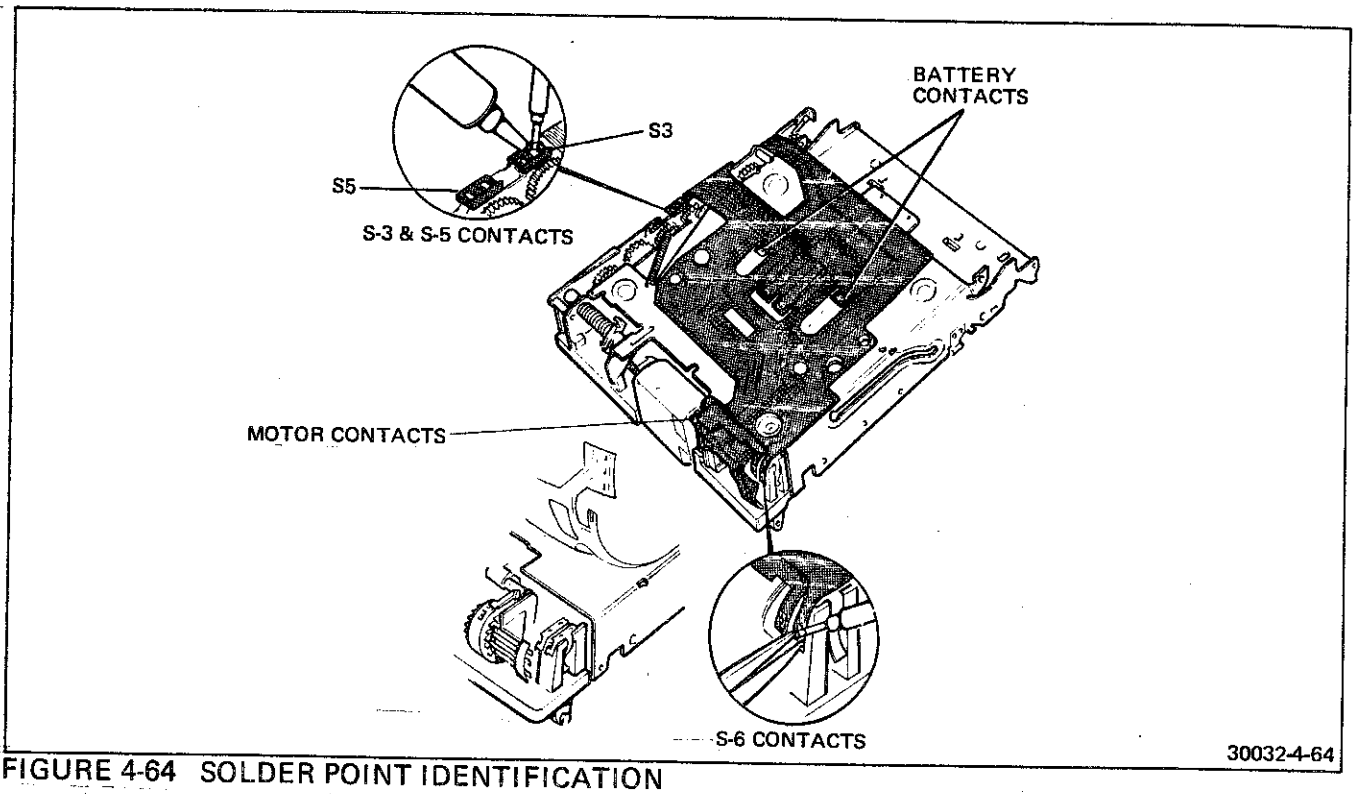


FIGURE 4-64 SOLDER POINT IDENTIFICATION

the starting position, check for mechanical binding. If no binding evident, check the reset pawl. The pawl spring must be correctly seated in the pawl groove.

NOTE: New counter, part no. 705863 assures better S8/S9 operation (Fig. 4-64A). Observe the 3 contact points. To be compatible, the flex circuit holes must mate with the offset contacts. New counter contacts are closed by a cam molded on the counter wheel. The drawing shows S8 closed in preparation for film insertion. When the wheel rotates to the '0' position, the same cam will close S9.

35. Slide the MCC holder into its mounting clip. Make certain that the insulating tongue of the flex circuit is in position between the MCC contacts and the motor frame. If the tab has been dislodged, carefully reinsert the tab.

36. Locate the flex circuit extension that reaches the two motor contacts, Figure 4-64. Using tweezers, press the flex circuit over the motor contacts until the contacts protrude through the flex circuit. If this step is performed correctly, the flex circuit will be held securely on the two motor contacts. Solder the two contacts.

37. Using tweezers and pressing lightly with the fingers, bend the flex circuit so that it meets the three contacts on the counter assembly (S8 and S9). Press the flex circuit over the three contacts and solder the contacts.

38. Depress the end of the flex circuit tab between the third switch contact and the inner surface of the frame. See Figure 4-64.

39. In the same manner, connect and solder the flex circuit to the S6 contacts.

40. Hold the Fresnel carrier in such a position that the drag link hangs straight down.

41. When performing this step, be careful that the drag link does not disturb the position of the motor drive coupling spring on its shaft. Low-

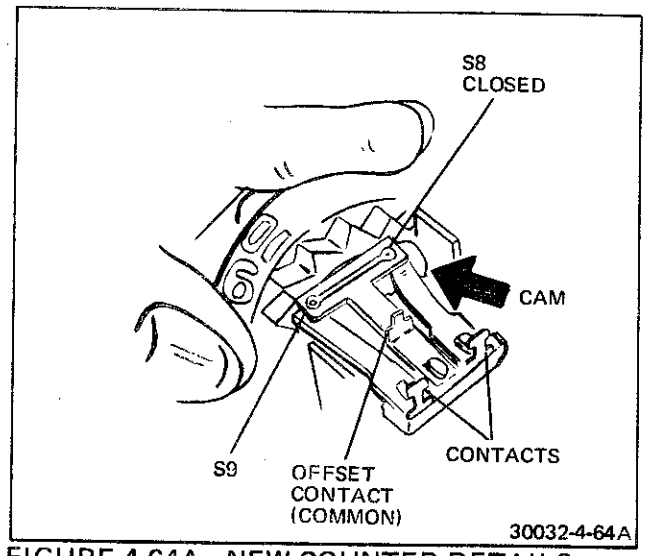


FIGURE 4-64A NEW COUNTER DETAILS

er the Fresnel carrier in such a manner that the slot in the drag link will engage with the cross bar of the bell crank.

42. Lift the opposite corner of the Fresnel carrier just enough to gain access to the drive pawl tension spring. With a blade of a small screwdriver, engage the free end of the spring and push it back into the pawl cavity (applying tension to the spring) as far as possible, at the same time, lower the corner of the Fresnel carrier until the hinge-pin holes are aligned.
43. Press the hinge pin into place so that the end of the pin is flush with the surface of the casting. In like manner, install the hinge pin on the other side of the carrier.
44. Carefully depress the carrier by hand while examining the two hinge areas to make certain there is no interference or binding.
45. Remove the protective sleeving from the Fresnel carrier.
46. Rotate the second gear in the gear train in the counterclockwise direction until the pick returns to its starting position and the carrier is down in its viewing position.
47. Check the carrier latch to make sure that it has correctly captured the carrier.
48. Check the drag link. It should be engaged with the drag link bell crank. If not, use needle-nose pliers and engage the drag link.
49. With the needle-nose pliers, grasp one of the override springs at its longer extension. Hook the shorter extension over one of the arms of the T-shaped drag link and into the groove in the arm.
50. Hook the longer spring extension into the corresponding groove in the arm of the bell crank.
51. In the same manner, install the second spring.
52. By rotating the second reduction gear in the counterclockwise direction, operate the gear train through one complete cycle to check proper operation of the system.
53. Insert the roller of the erecting link into the hole at the end of the curved slot and slide the link into place.
54. Hold the cover assembly in such a position that the S6 actuator hangs straight down.
55. Lower the housing so that the free-hanging actuator passes through the cutout in the inner frame assembly toward the S6 contacts. See Figure 4-65.
56. Snap the boot retainer over the tabs on the inner frame.

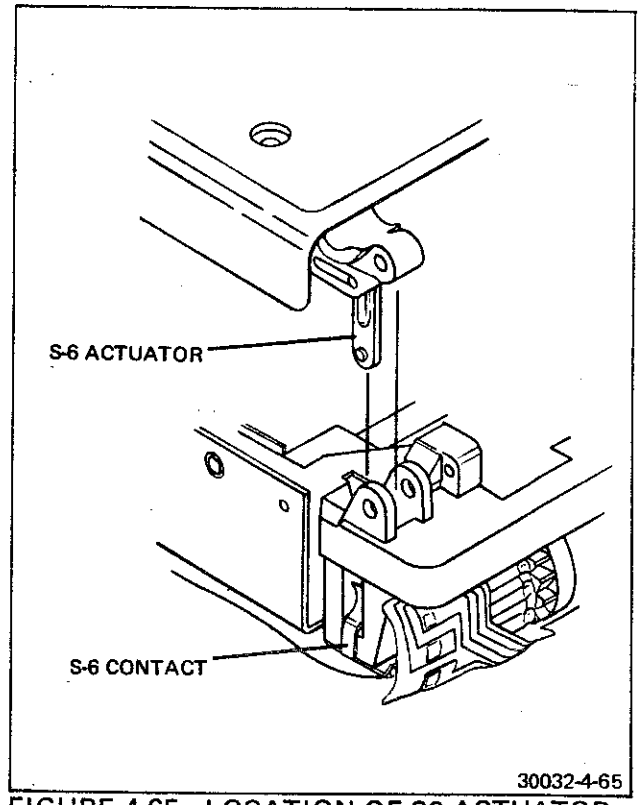


FIGURE 4-65 LOCATION OF S6 ACTUATOR LINK

57. Reinstall the two mirror-cover-to-inner-frame hinge pins.
58. Open the front cover, remove the film pack, and remove the front cover.
59. Position the shutter assembly on the hinge bracket and mate the locating studs with the locating holes.
60. Install and tighten the four retaining screws.
61. Identify the second gear from the motor end of the gear train. Rotate this gear in the counterclockwise direction until the mirror is in the exposure position.
62. Install and tighten the three inner-frame-to-boot retainer screws.
63. Install the hinge-bracket-to-inner-frame hinge pins.
64. Check the camera for proper operation.
65. Install the gear-train cover.
66. Slide the bottom cover into position.
67. Install and tighten the four cover retaining screws.
68. Replace the decorative leather covering on the bottom cover.
69. Squeeze the sides of the front cover just enough to engage the pivot points.

70. Close the cover and check the camera.

T. EXPOSURE COUNTER, REMOVE

The obvious indication of counter malfunction would be its failure to correctly register the number of pictures remaining. It is important, however, to be aware that switches S8 and S9 are integral components of the counter assembly and if the switches become defective, the counter assembly must be removed and replaced.

The counting mechanism is subject to wear and damage in the ratchet/pawl areas. Ratchet teeth may become worn or damaged. The drive pawl and/or the reset pawl can be broken or their mounting points worn or damaged.

The spring contacts of switches S8 and S9 can suffer fatigue. The contact points, as in any switch, can become dirty or corroded. If other repairs require electrical disconnection of S8 and S9, the switches can be damaged by improper soldering techniques. Whatever the malfunction or its cause, the counter must be removed and replaced. If repairs are performed in the MCC area, it is possible to damage the clip which supports the MCC holder. The clip is a part of the counter assembly and so the counter must be replaced. Removal and replacement of the counter is accomplished in the following manner.

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover close to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will force the pivot from its mount and allow the front cover to be removed.
4. Carefully peel the leather decorative covering from the bottom cover.
5. Remove the four screws from the bottom cover.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Leave the camera open. It will be easier to support the camera in a convenient working position.
9. Insert an empty film pack to prevent solder from entering the film chamber, and to set the counter mechanism in a configuration necessary to permit removal and replacement.
10. Using the specified soldering iron and solder-removing device, unsolder the three S8/S9 switch contacts.
11. Use tweezers and lift off the flex circuit tab.
12. In like manner, unsolder the two S6 contacts.
13. Using tweezers, slide the MCC holder out of its mounting clip.
14. Carefully roll back the flex circuit just enough to provide access to the counter screws.
15. Remove the two screws which secure the counter assembly to the inner frame. See Figure 4-66.
16. Grasp the MCC mounting clip with tweezers and lift out the counter.

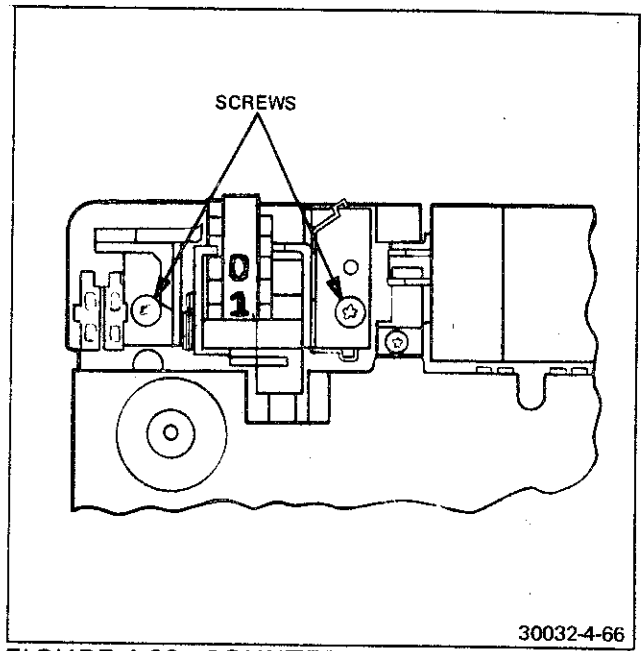


FIGURE 4-66 COUNTER BRACKET SCREWS

U. EXPOSURE COUNTER, INSTALL

NOTE: See Introduction for method to repair stripped screwholes.

1. Before installing the replacement counter, the two pawls must be correctly positioned. Proceed as follows:
2. Identify the drive pawl. Use a dental pick and rotate the drive pawl so that it enters the cavity

in the inner frame. Hole the pawl in this position (Figure 4-67).

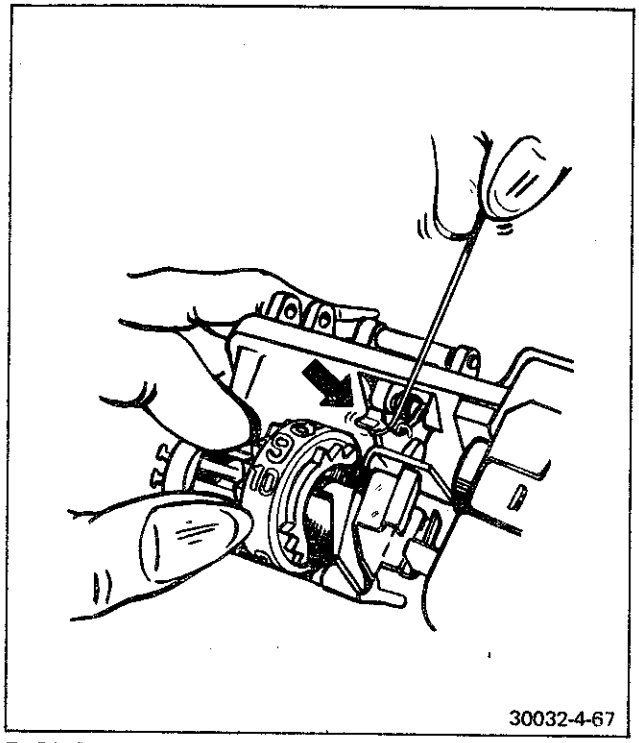


FIGURE 4-67 HOLDING DRIVE PAWL DURING COUNTER INSTALLATION

3. Identify the reset pawl.
4. A narrow tongue extends across the end of the reset pawl. Place this tongue into the forked end of the reset-pawl spring and move the counter assembly into place. The counter assembly mounting bracket is provided with four holes; two for locating pins and two for the mounting screws. The shape and size of the counter is such that only the locating holes will mate with the locating pins.
5. Bring the locating holes as close to the pins as the steel dental pick will permit, then simultaneously slide out the shim and drop the counter over the locating pins.
6. Install and tighten the two mounting screws.
7. Check the operation of the counter. Manually rotate the counter to 0 on the dial. Remove and reinstall the film pack. The counter should return to its starting position. Check for mechanical binding. Check the reset pawl. The pawl spring must be correctly seated in the pawl groove.
8. Slide the MCC holder into its mounting clip. Make certain that the insulating tongue of the flex circuit is in position between the MCC contacts and the motor frame. If the tab has been dislodged, carefully reinsert the tab.
9. Using tweezers and pressing lightly with the fingers, bend the flex circuit so that it meets the three contacts at S8 and S9 with a small-radius bend.
10. Using tweezers, position the flex circuit over the three S8/S9 contacts. Span the contacts with the tips of the tweezers (one contact at a time) and press the circuit over the contacts so that each contact protrudes through the solder pad of the flex circuit.
11. Solder the three contacts.
12. Dress the end of the flex circuit tab between the third switch contact and the inner surface of the frame. See Figure 4-68.
13. In the same manner, connect and solder the flex circuit to the two S6 contacts.
14. Check the camera for proper operation.
15. Install the gear-train cover.
16. Slide the bottom cover into place.
17. Install and tighten the four cover retaining screws.
18. Replace the decorative leather covering on the bottom cover.
19. Squeeze the sides of the front cover just enough to engage the pivot points.
20. Close the cover and check the camera.

V. MOTOR, REMOVE

The motor is the prime mover of the SX-70 camera. If the motor fails to rotate, none of the normal camera functions can occur. A number of reasons can be the cause of motor failure but the most obvious, and most frequently ignored, is loss of power as a result of battery failure. Before any other troubleshooting or testing is attempted, a film pack with batteries of known quality must be placed in the camera, or, if available, use the film pack simulator described previously.

Motor failures can be caused by two general types of malfunction. The first can be described as mechanical; gears jammed or overloaded, mechanical linkages deformed, dirt on moving assemblies, etc. The second general category involves electrical malfunctions, dirty contacts, short or open circuits, faulty MCC, switches, etc. Testing and troubleshooting procedures will isolate the motor as the faulty component. Removal and replacement is accomplished in the following manner.

1. Erect the camera to picture-taking configuration.

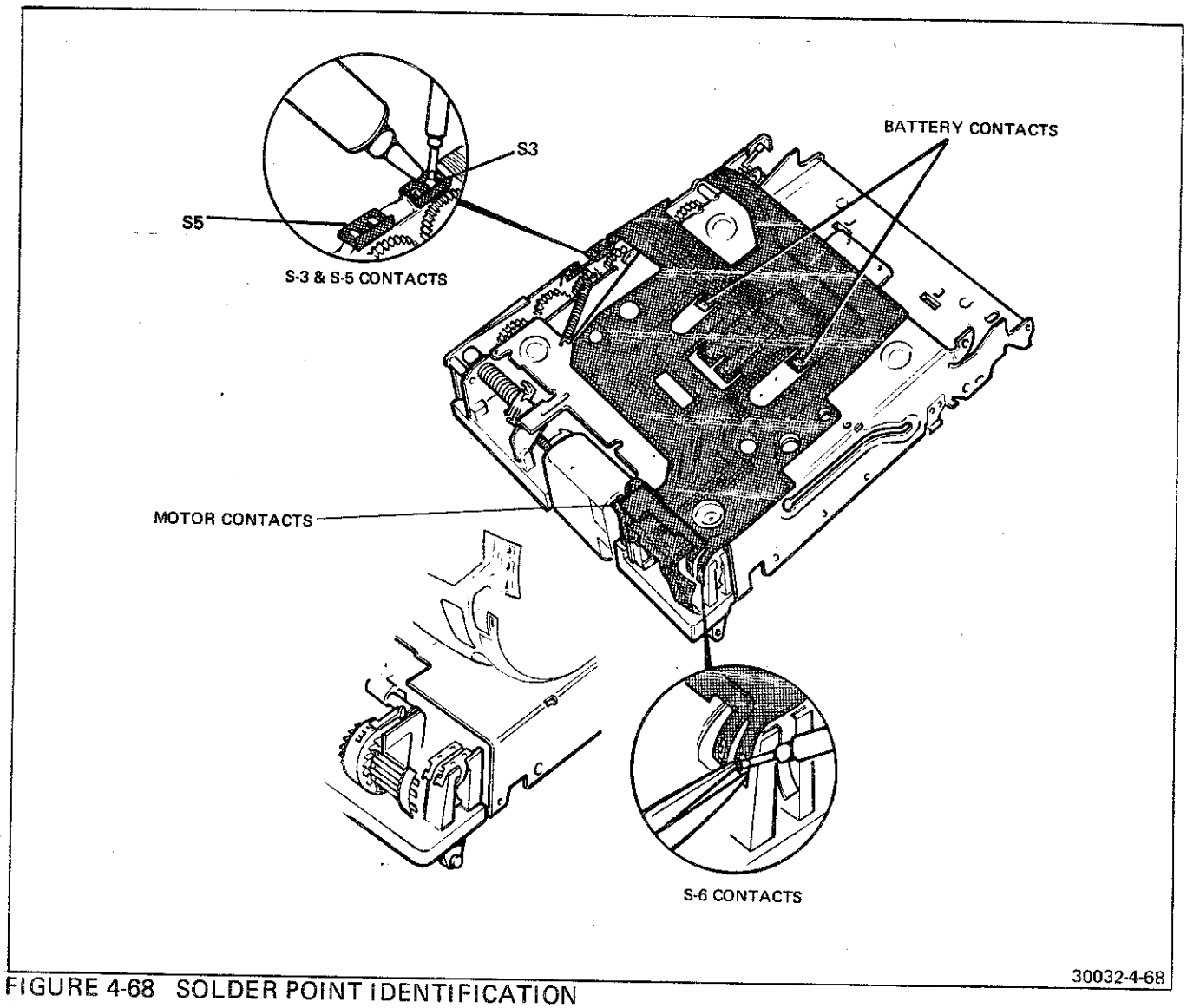


FIGURE 4-68 SOLDER POINT IDENTIFICATION

2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.

3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will force the pivot from its mount and allow the front cover to be removed.

4. Carefully peel the leather decorative covering from the bottom cover.

5. Remove the four screws from the bottom cover.

6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.

7. Slide the cover from the assembly.

8. Leave the camera open. It will be easier to support the camera in a convenient working position.

9. Insert an empty film pack to prevent solder and/or rosin splashes from entering the film chamber.

10. Using the specified soldering iron and solder-removing device, unsolder the two motor contacts.

11. Use tweezers and lift off the flex circuit tab. Use tweezers and slip the MCC holder out of its retaining clip.

12. Carefully roll back the flex circuit just enough to provide access to the motor retaining screws.

13. The motor is secured in place by two curved clamps that partially encircle the motor bearing housings. Each clamp is secured by a single screw. Loosen the two screws and swing aside the two clamps. See Figure 4-69.

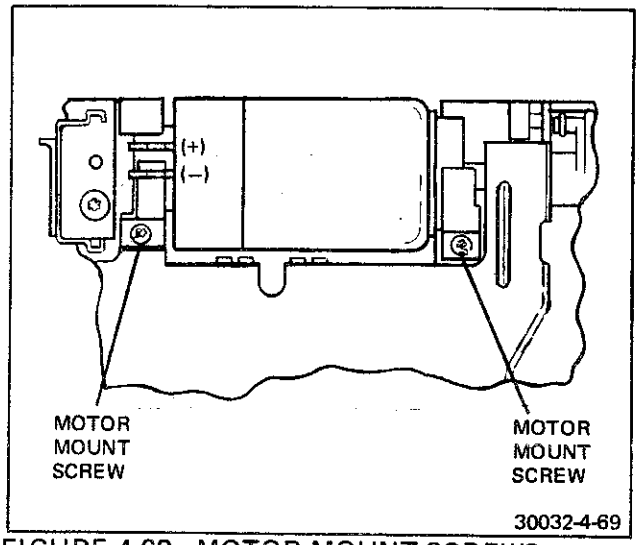


FIGURE 4-69 MOTOR MOUNT SCREWS

14. Slowly lift out the end of the motor that includes the two electrical contacts. The coupling spring is sufficiently flexible to sustain a relatively sharp-radius bend without damage.
15. Carefully withdraw the motor so that the coupling spring slips from the plastic coupling.
16. Remove the motor and coupling spring.

W. MOTOR, INSTALL

NOTE: See Introduction for method of repairing stripped screwholes.

1. Procure a replacement motor assembly.
2. Before installing the motor, it is imperative that the coupling spring position be critically checked. Use the flex coupling gage (Special Tool #11679). Place the gage as shown on Figure 4-70. The end of the coupling spring should be flush with the end surface of the gage. If the spring extends beyond the gage, leave the motor on the bottom (support) end of the gage. Lift off the upper half of the gage and use a jeweler's screwdriver to move the spring further onto the shaft. If the spring does not reach the end of the gage, remove the gage and, using a jeweler's screwdriver, work the spring further from the motor flange.
3. Refer to Figure 4-71. Hold the motor as shown. The motor pinion shaft can be rotated by manually operating the gear train. Rotate the shaft so that the cross tang on the coupling spring is correctly aligned with the slot in the coupling.
4. Slide the coupling spring into the slot of the plastic coupling as the motor is placed into position. Seat the two motor shock mounts into the semi-circular mounting sockets in the housing.
5. Tighten the clamp screws.

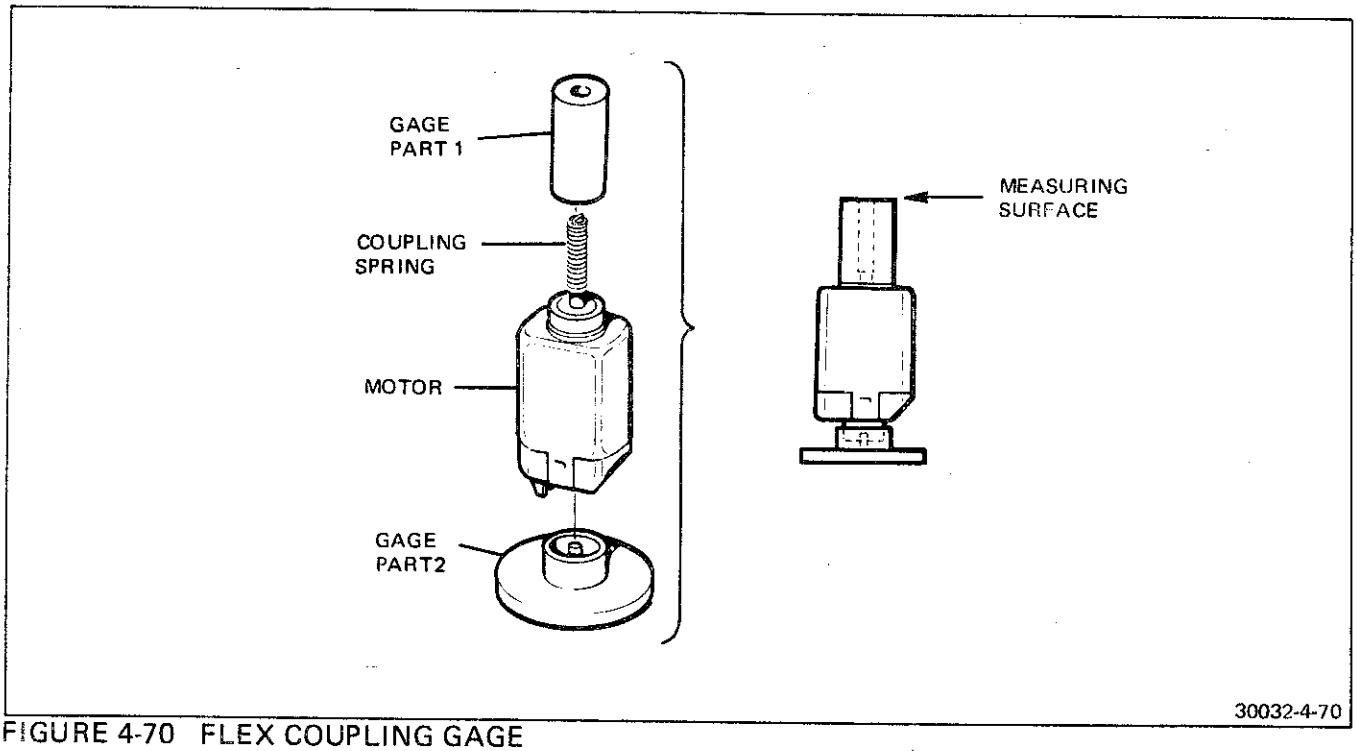


FIGURE 4-70 FLEX COUPLING GAGE

6. The motor can be rotated very slightly in its clamps. Examine the installation carefully and rock the motor slightly in its mountings to make sure the motor is properly seated. Recheck and, if necessary, retighten the mounting screws.

7. The outer plate (gear train) must be firmly seated against the surface of the inner frame before the following checks are made. If necessary, tighten the outer-plate mounting screws. Manually rotate the gear train so that the slot in the shaft can be seen.

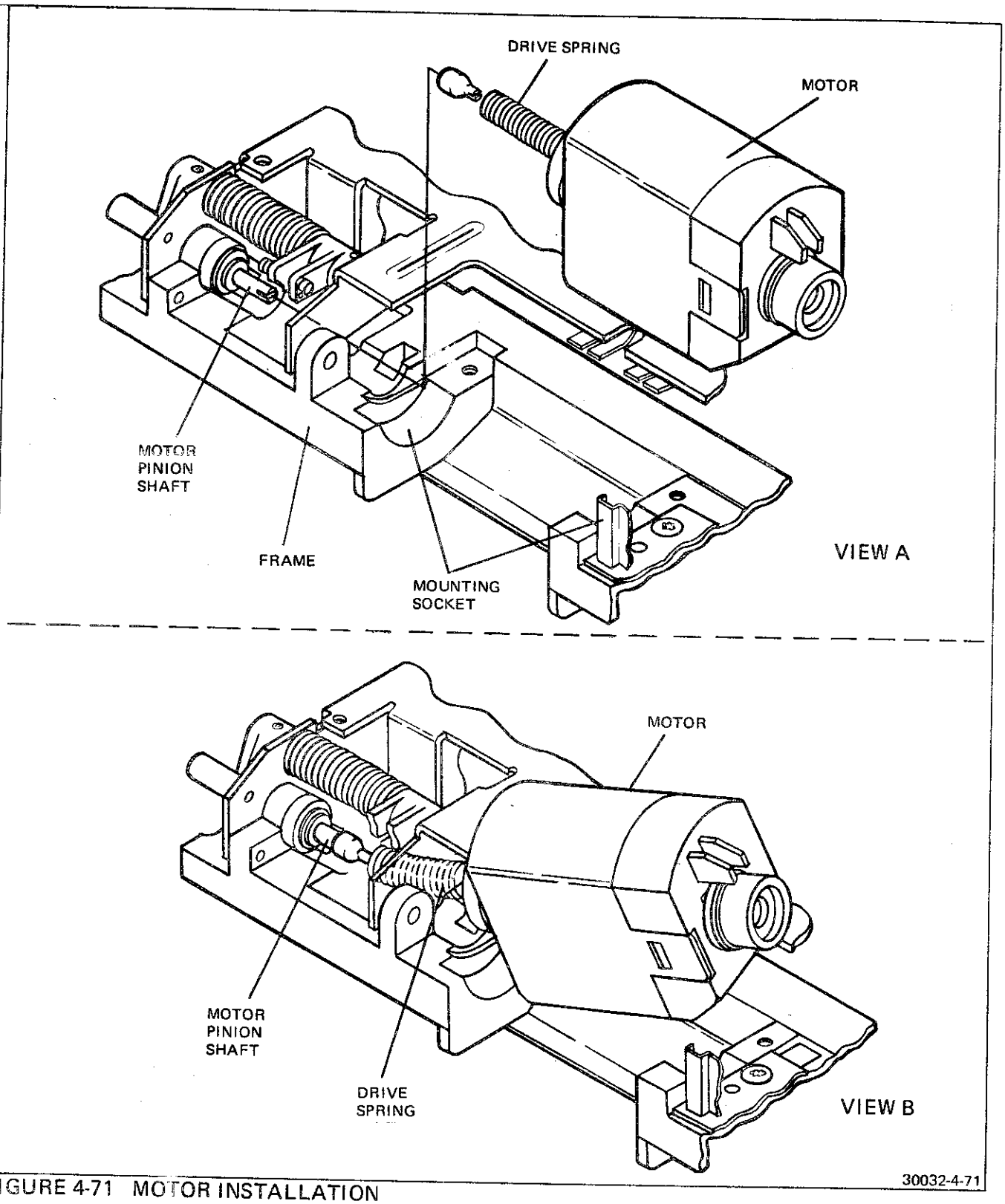


FIGURE 4-71 MOTOR INSTALLATION

8. Grasp the pinion shaft with tweezers and move the shaft toward the motor as far as the end play will permit.
9. Release the pinion shaft and grasp the motor shaft between the end of the coupling spring and the motor mount.
10. Visually check the gap between the drive-spring tang and the bottom of the slot in the plastic coupling. Grasp the motor shaft with tweezers and remove all end play in the direction of the pinion. At the same time, apply pressure to the outer surface of the pinion gear to remove play in that direction. The gap dimension should be approximately equal to the diameter of the spring wire.
11. If the gap is too small or nonexistent, use the small end of Special Tool #11679 to apply pressure to the end of the motor shaft (the end opposite the drive end). While holding the motor shaft against the limit of its forward travel, work the spring onto the shaft with a jeweler's screwdriver. Move the spring only enough to provide the necessary clearance.
12. If there is too much space between the drive-spring tang and the bottom of the coupling slot, the spring must be moved toward the coupling. Use the jeweler's screwdriver and carefully work the spring away from the motor housing until the gap requirement is satisfied.
13. After the motor is installed and checked, slide the MCC holder into its mounting clip. Make certain that the insulating tongue of the flex circuit is in position between the MCC contacts and the motor frame. If the tab has been dislodged, carefully reinsert the tab.
14. Locate the flex circuit extension that reaches the two motor contacts, Figure 4-72. Using tweezers, press the flex circuit over the motor contacts until the contacts protrude through the flex circuit. If this step is performed correctly, the flex circuit will be held securely in place on the two motor contacts.
15. Solder the two motor contacts.
16. Check the camera for proper operation.
17. Slide the bottom cover into place.
18. Install and tighten the four cover retaining screws.
19. Check the camera for proper operation.
20. Replace the decorative leather covering on the bottom cover.
21. Squeeze the sides of the front cover just enough to engage the pivot points.
22. Close the cover and check the camera.

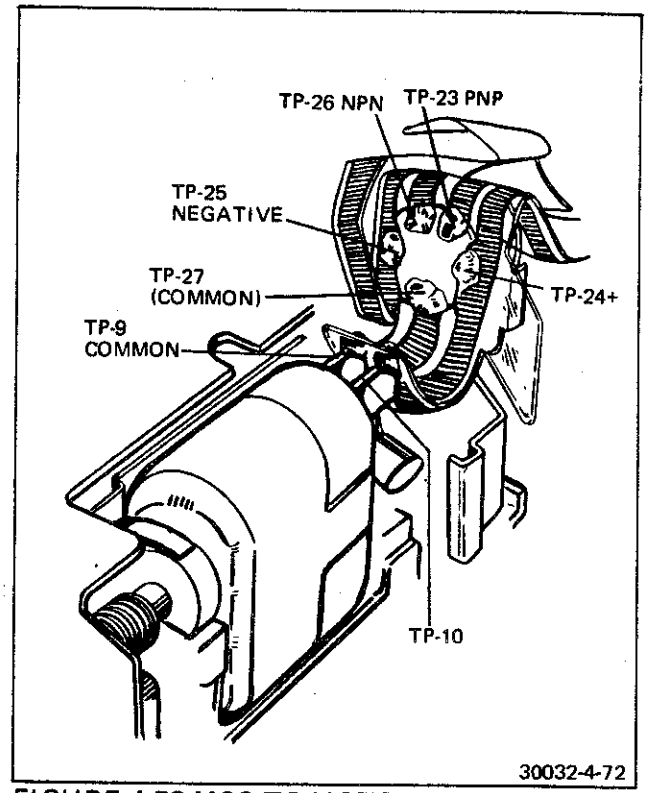


FIGURE 4-72 MCC TO MOTOR CONNECTIONS

X. FLEX CIRCUIT, REMOVE

The Flex Circuit is a flexible printed circuit that provides the electrical interconnections throughout the camera. Once in place, it is not subject to damage from camera mishandling. Likewise, wear is not involved. For these reasons, removal and replacement of the flex circuit will only be required if the circuit is damaged when other repairs are performed, or when sections of the circuit or the complete circuit must be removed to gain access to other components. The flex circuit is removed and replaced in the following manner.

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit in-

sertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.

7. Slide the cover from the assembly.

   Caution: While performing any soldering or unsoldering operations, a discarded film pack must be installed in the camera to prevent solder or flux from dropping or spattering into the film compartment area.

   NOTE: Use only the miniature soldering iron when performing the following tasks.

8. To unsolder the flex circuit end of the multiwire ribbon cable, refer to Figure 4-73. Starting with lead No. 1 of the cable, insert the point of a sharp blade (a pointed blade Xacto knife is recommended) under the wire. The sharpened edge of the blade must be held so that it makes physical contact with the junction point of the wire lead and the solder pad of the flex circuit. **Do not** insert the point of the blade beyond lead No. 1.
9. By exerting a slight clockwise twist to the blade, apply upward pressure to the end of the lead.
10. While maintaining a steady upward pressure with the knife blade, bring the tip of the soldering iron into contact with the copper pad on the side of the soldered connection opposite the cable lead.
11. At the instant that the knife blade breaks the soldered joint, remove the soldering iron. Hold the knife blade steady for a moment to allow the pad and the wire to cool.
12. Repeat steps 8 through 11 for each of the cable leads.

    Caution: Under no circumstances attempt to heat and remove more than one lead at a time.

13. In order to facilitate further procedures, close the camera and place it face down on the workbench.
14. Using a solder remover, remove the solder from the two battery contacts. See Figure 4-74. In most cases, removing the solder will not completely free the flex circuit connections. Use tweezers and a soldering iron, heat the connection, and lift off the flex with the tweezers.

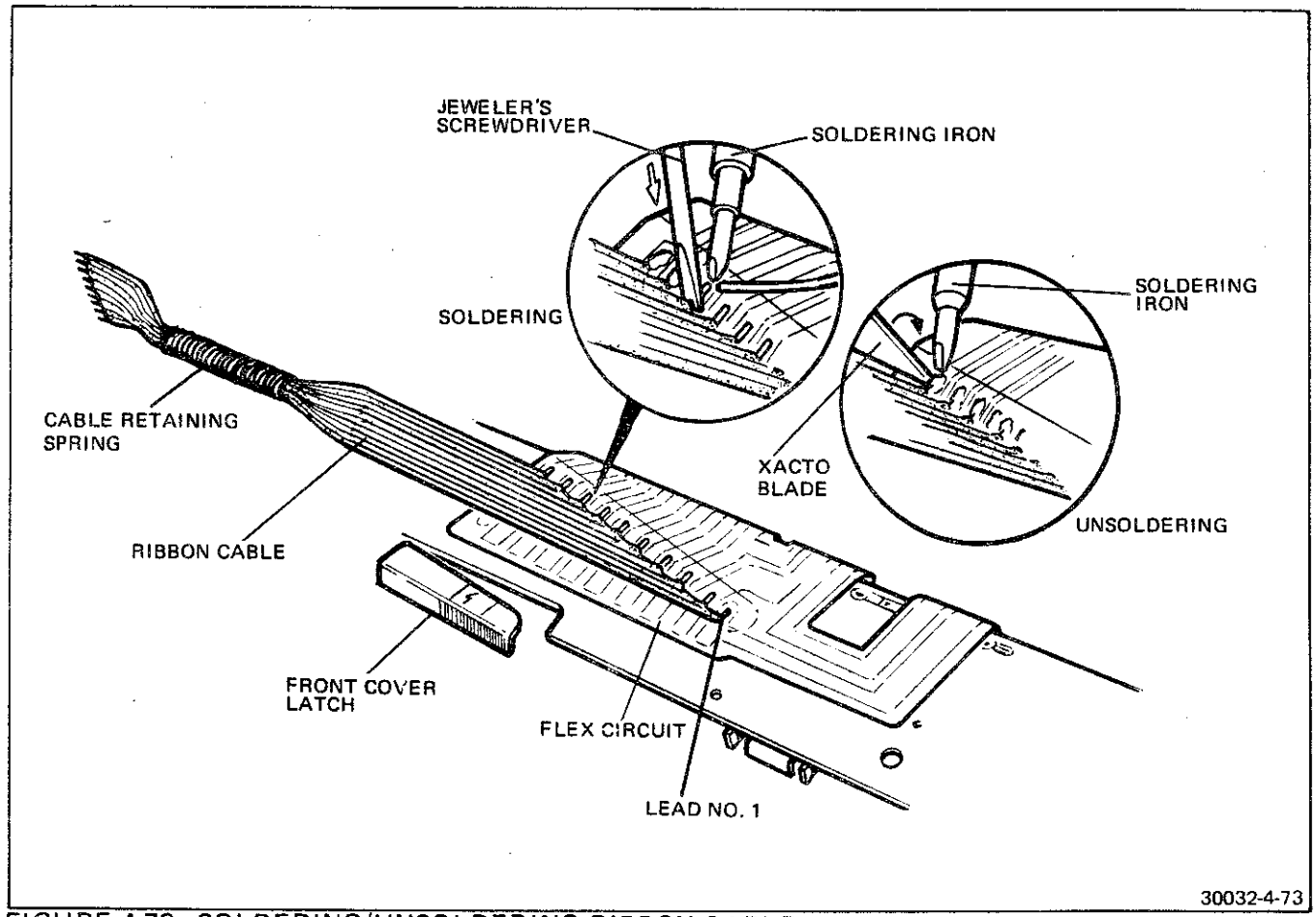


FIGURE 4-73 SOLDERING/UNSOLDERING RIBBON CABLE

15. Using the solder remover and, if necessary, the tweezers and soldering iron, unsolder the S6 contacts. See Figure 4-74.
16. In like manner, disconnect the S8 and S9 contacts.
17. In like manner, disconnect the two motor contacts. See Figure 4-74.
18. In like manner, disconnect the S3, S5, and S7 contacts.
19. Check to see that all flex circuit connections are free and carefully slide the MCC (motor control circuit) out of its holder adjacent to the counter.
20. Remove the flex circuit.
21. Remove the MCC holder from the MCC and retain the holder.

Y. FLEX CIRCUIT, INSTALL

1. If a new flex circuit is to be installed, discard the old circuit complete with its MCC. Attempting to remove the MCC from the flex circuit would probably destroy the MCC.
2. Prior to installing the new flex circuit, a new MCC must be installed on the flex circuit. Refer to Figure 4-75 for proper location of the MCC tab and put the MCC in place on the circuit.

NOTE: Because of the restricted space in which

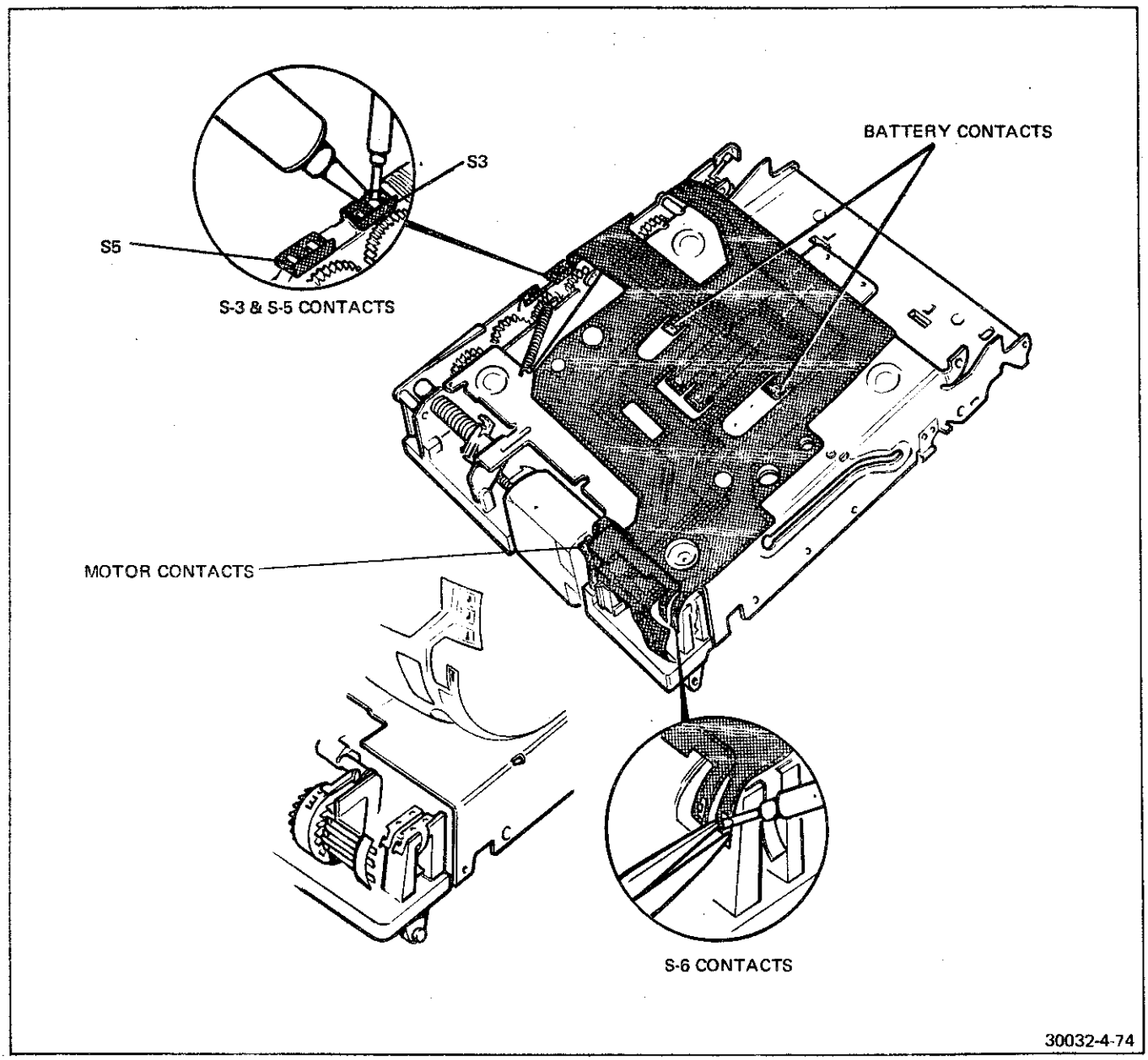


FIGURE 4-74 SOLDER POINT IDENTIFICATION

I - DESCRIPTION

A. GENERAL DESCRIPTION

The Polaroid Land SX-70 is a folding, pocket sized, single-lens reflex camera which takes and immediately delivers full-color pictures approximately 3¼ inches square (see Figures 1-1, 1-2 and 1-3). Operation is automatic. The user merely inserts the film, focuses and shoots. Power is provided by a six-volt battery inside the film pack; therefore, the batteries are always as fresh as the film.

The four element lens has a maximum aperture of f/8, and a focusing range from 10.4 inches to infinity. The shutter is automatically controlled by a photocell and electronic timing. Electrical to mechanical energy conversion is accomplished by a solenoid. There is no separate diaphragm adjustment. The shutter opening and separation time is controlled by the exposure measuring system.

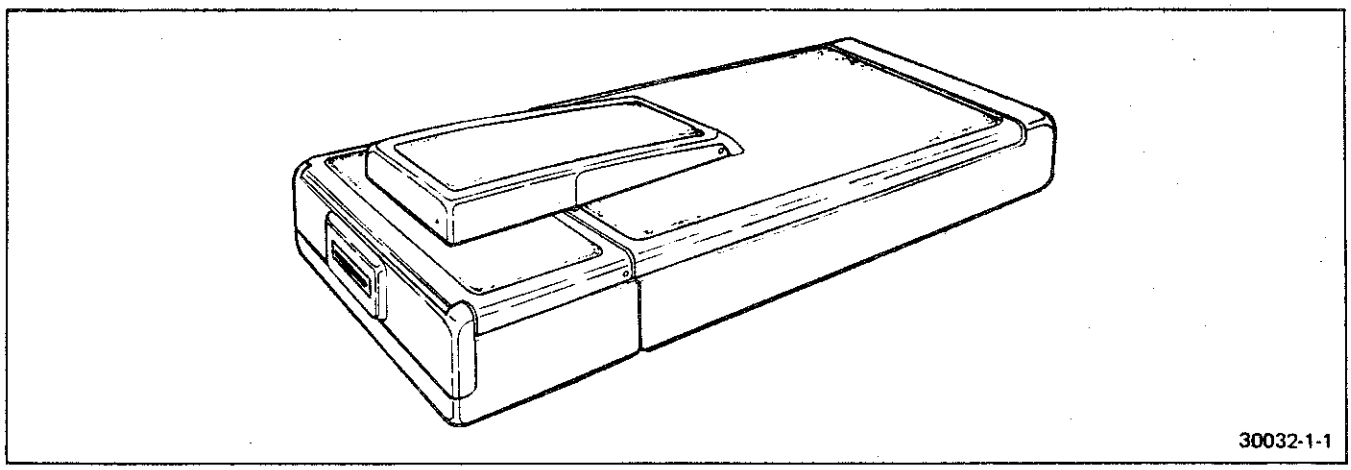


FIGURE 1-1 SX-70 CAMERA FOLDED

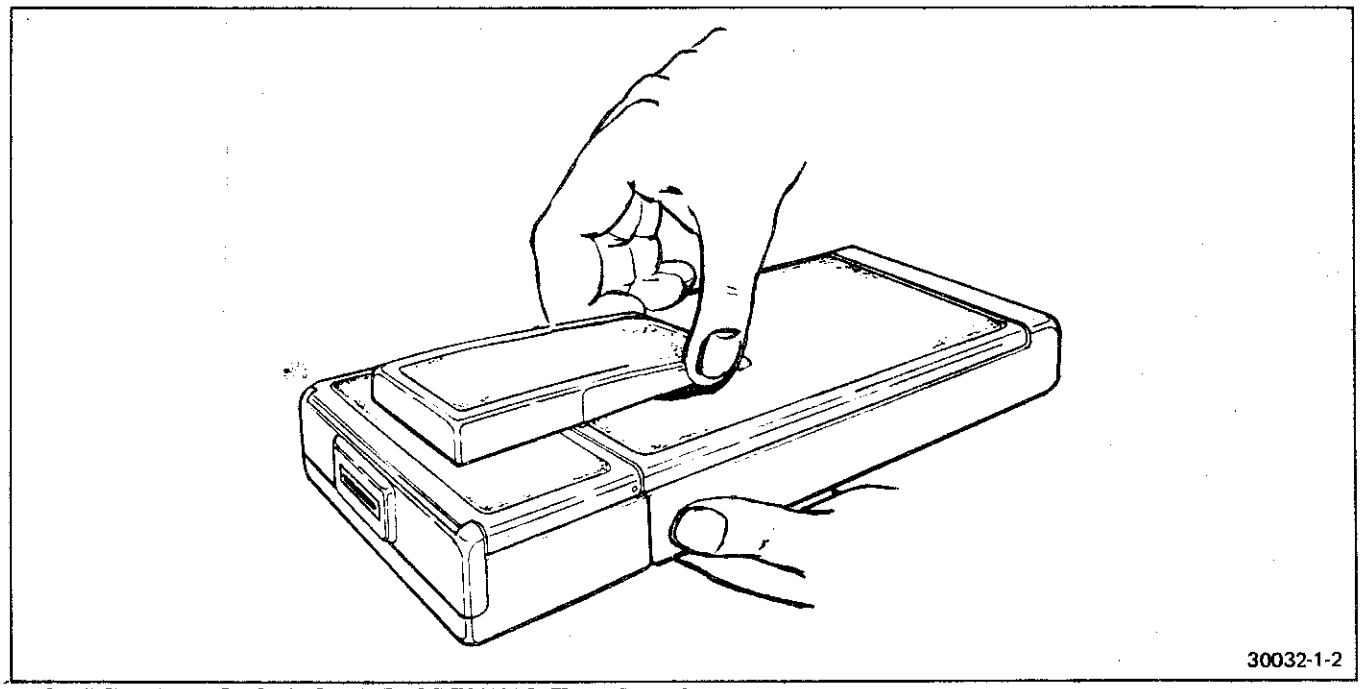


FIGURE 1-2 HOLDING AND OPENING THE SX-70

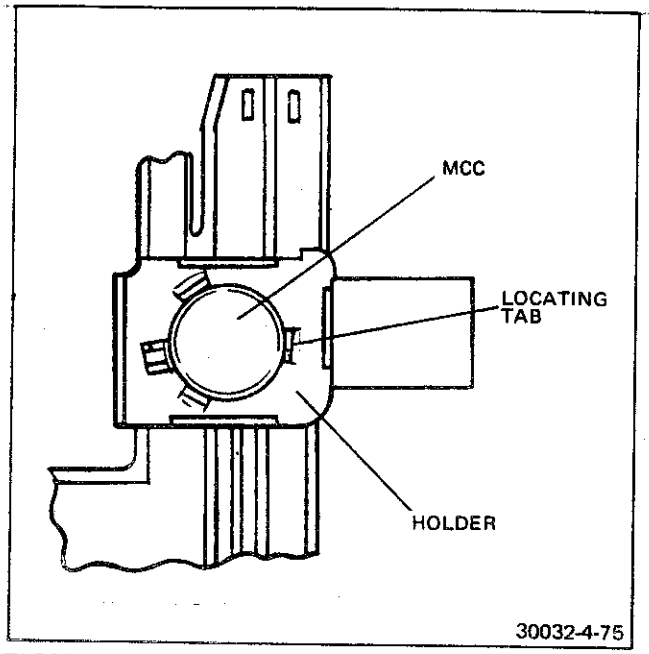


FIGURE 4-75 LOCATING TAB POSITION ON MCC

the MCC is mounted, it is imperative that no sharp projections (cut wire ends for example) are left at the MCC solder points. It is also important that the size of the soldered connections be kept to the minimum. To satisfy these requirements, the following soldering procedures must be strictly adhered to.

3. **Before soldering,** cut the leads. Use a miniature diagonal cutter. Hold the MCC tightly against the flex circuit. Hold the cutter jaws flat against the foil surface and cut an MCC lead at that distance from the surface.
4. Cut the remaining leads in the same manner.
5. Place the flex circuit on the workbench with the MCC on the underside.
6. Apply a tweezers to the flex circuit in such a manner that the tips just span one of the MCC solder pads.
7. Press lightly on the tweezer tips and apply just enough solder to cover the sharp end of the MCC lead and provide a smooth, rounded surface.
8. In like manner, solder the remaining MCC leads.
9. Set the flex circuit in place using the two battery contacts as locating points.
10. Spread the points of tweezers in such a manner that the points will span one of the battery contacts.
11. Press down on the flex circuit until the contact protrudes through the flex circuit and the circuit lies flat.
12. In the same manner, press the flex circuit onto the second battery contact.
13. Solder the flex circuit to both battery contacts.
14. Refer to Figure 4-75 and press the MCC holder into place on the MCC.
15. Slide the MCC holder into its clip in the side of the counter assembly.
16. Locate the flex-circuit extension that reaches the two motor contacts, Figure 4-72. Using tweezers, press the flex circuit over the motor contacts until the contacts protrude through the flex circuit. If this step is performed correctly, the flex circuit will be held securely in place on the two motor contacts.
17. Solder the two motor contacts.
18. Using tweezers, fold back the extension tab of the flex circuit so that it can be pressed into place between the MCC soldered connections and the motor frame.
19. Using tweezers and pressing lightly with the fingers, bend the flex circuit so that it meets the three contacts at S8 and S9 with a small radius bend.
20. Using tweezers, position the flex circuit over the three S8/S9 switch contacts. Span the contacts with the tips of the tweezers (one contact at a time) and press the circuit over the contacts so that each contact protrudes through the solder pads of the flex circuit.
21. Solder the three contacts.
22. Dress the end of the flex circuit tab between the third switch contact and the inner surface of the frame. See Figure 4-74.
23. In the same manner, connect and solder the flex circuit to the two S6 contacts.
24. Carefully form the flex circuit so that it will not make contact with the gears.
25. Connect and solder the flex circuit to the four contacts of switches S3 and S5.
26. In the same manner, connect and solder the flex circuit to the contacts of S7. Form the flex circuit so that it will not make contact with the gears.
27. Prepare a piece of double-faced tape, 1½ by ½ inches.
28. Apply the tape to the camera body at the point where the ribbon cable meets the flex circuit in such a manner that the tape extends ¾ inch beyond the flex circuit toward the shutter.
29. Fold the flex circuit over the edge of the frame.

Make sure that the end of the flex circuit is parallel to the edge of the frame.

30. Press the flex circuit into contact with the tape to secure the flex circuit to the frame.
31. Position the locating pins on the rear of the shutter in the holes on its mounting hinge and install the four retaining screws.
32. Dress the multi-wire ribbon cable in the direction of the flex circuit.
33. Locate the short projecting end of the cable retaining spring and the hole at the base of the cable clamp.
34. Install the spring in the clamp in such a manner that the projection enters the hole in the clamp.
35. Crimp the clamp on the spring with just enough pressure to capture the spring. It does not have to be a tight joint.
36. Examine the flex circuit solder pads. If the solder is not deposited smoothly, reheat and smooth the solder pads.
37. Apply a small quantity of Alpha no. 611 to the flex circuit pads and the ends of the ribbon cable.
38. Orient the cable and dress the end of each lead so that it seats squarely in the center of its solder pad, and hold the cable firmly in this position.
39. Refer to Figure 4-76. Place the blade of a jeweler's screwdriver on top of the bare end of the number one lead exactly at the point where the insulation begins. Press down firmly to create a positive heat sink.
40. Apply the tip of the soldering iron so that it makes simultaneous contact with the pad and the tinned end of the wire lead.
41. Hold the iron in place just until the solder on the wire and the pad flow into a smooth joint.
42. Do not remove the screwdriver blade until the solder has cooled (one or two seconds).
43. Apply a small amount of Alpha no. 1001 Reliasolv solvent to clean the soldered joints, and wipe dry with a Q-tip.
44. Slide the bottom cover into place.
45. Install and tighten the four cover-retaining screws.
46. Squeeze the sides of the front cover just enough to engage the pivot points.
47. Close the cover and check the camera.
48. Reinstall the leather on the bottom cover.

NOTE: The first cameras produced had 10 lead solder pads and shutter cables; subsequent design changes then eliminated two leads which

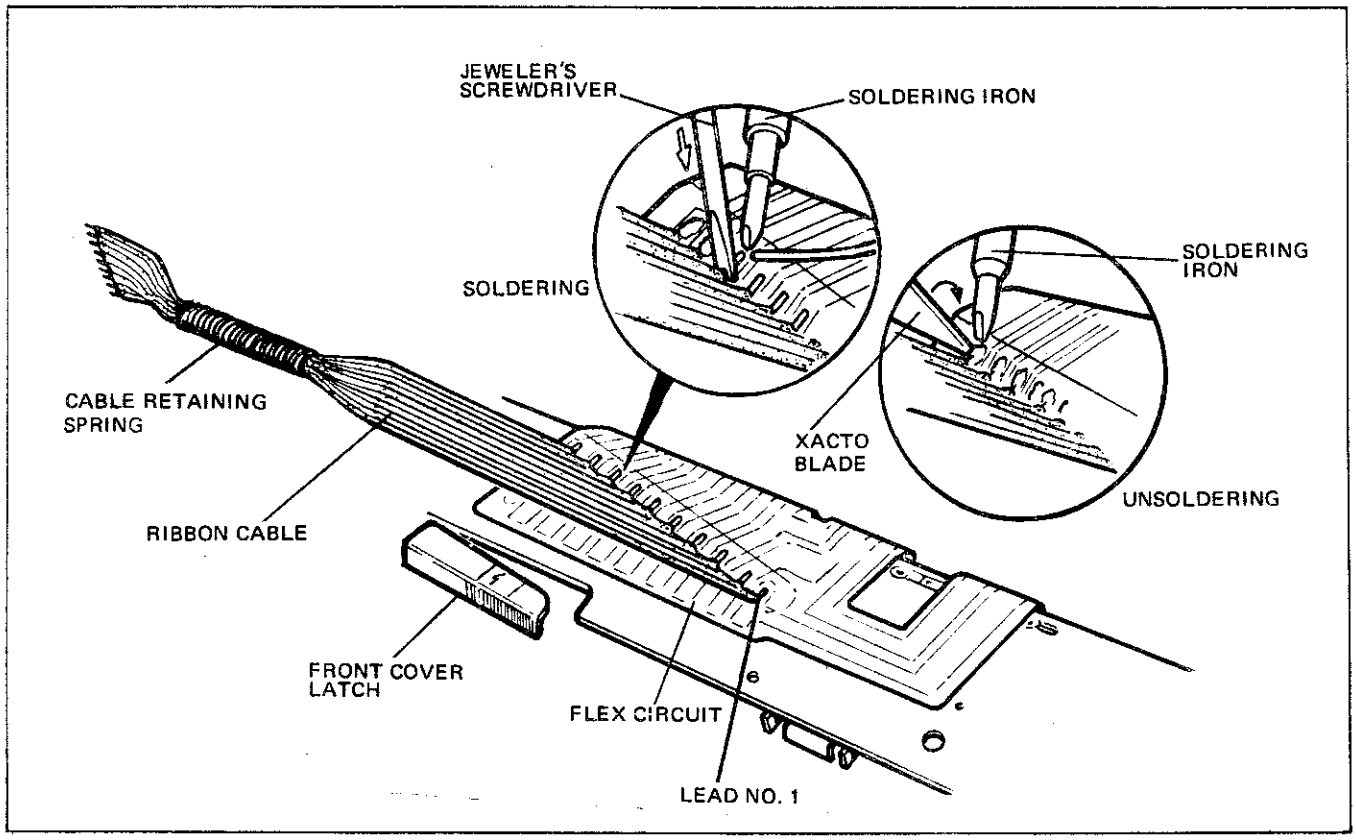


FIGURE 4-76 SOLDERING/UNSOLDERING RIBBON CABLE

were originally used for temperature sensing; a further change has now eliminated an additional lead (for the MCC-PNP). Consequently, there are now three versions of shutters and cables in existence; the 10 pad 10 cable; 8 pad 8 cable; and 7 pad 7 cable types. Also a newly designed Texas Instrument shutter with a printed circuit board replacing the ceramic substrate will soon be used. The flexible cable connections to the flex circuit pads on the gear-train side of the camera may be made if the following procedures are used.

1. *To attach an 8 wire cable to the 10 pad flex circuit, separate the leads so that lead number 2 is pulled away from lead number 3. (Lead number 1 is the longest.)*
2. *Attach the shutter cable retaining spring to the clamp. The 8 lead cable has a hook, not the right angle lead of the 10 lead type.*
3. *Hook in the spring and push it in as far as possible. Arrange the spring coils without stress and clamp them in the bracket (Figure 4-31).*
4. *Mount the shutter by one screw.*
5. *Arrange the 3rd, 4th, 5th and 6th cable leads on the 5th, 6th, 7th and 8th solder pads of the flex circuit (See Figure 4-77).*
6. *Solder these 4 leads.*
7. *Solder leads 1 and 2 to solder pads 1 and 2 on the flex circuit.*
8. *Lastly, solder leads 7 and 8 to solder pads 9 and 10.*
9. *Test shutter and camera action.*
10. *Finish mounting shutter.*

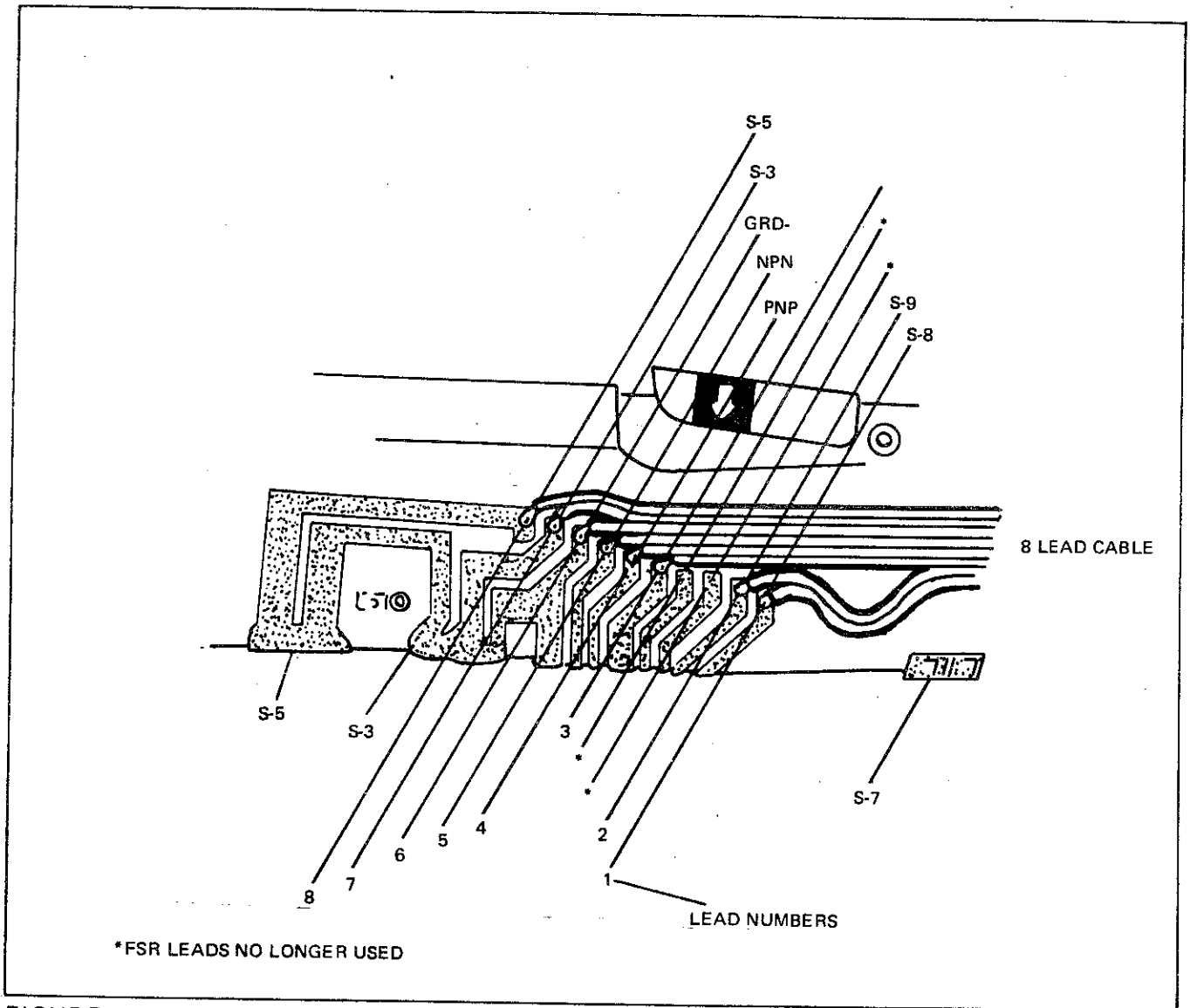


FIGURE 4-77 CONNECTING 8 WIRE SHUTTER CABLE TO 10 PAD FLEX CIRCUIT

Cameras have also been produced with 8 and 7 pad flexible circuit solder pads. To attach a 10 cable wire from the shutter to an 8 pad flexible circuit, follow these steps. See Figure 4-78.

1. *Count the longest cable wire as lead No. 1 and remove lead wires 3 and 4.*
2. *Attach the shutter cable retaining spring to the smaller hole in the cable bracket. Hold the spring without stress and clamp it in the bracket.*
3. *Mount the shutter with one screw.*
4. *Solder leads 1 and 2 to the number 1 and 2 solder pads on the flexible circuit.*
5. *Solder the remaining leads to their same numbered flexible circuit pads.*
6. *Test shutter and camera operation.*
7. *Finish mounting shutter.*

The 7 wire cable can be used only with the 7 pad flexible circuit. It is not interchangeable with any other unit.

Z. SWITCHES

There are nine switches involved in the automated functions of the SX-70 camera. Solid-state switching circuits which are incorporated in the shutter circuit board are not included in this discussion. Each of the nine switches is subject to failure caused by dirt and corrosion, fatigue and distortion as in any electro/mechanical switching device.

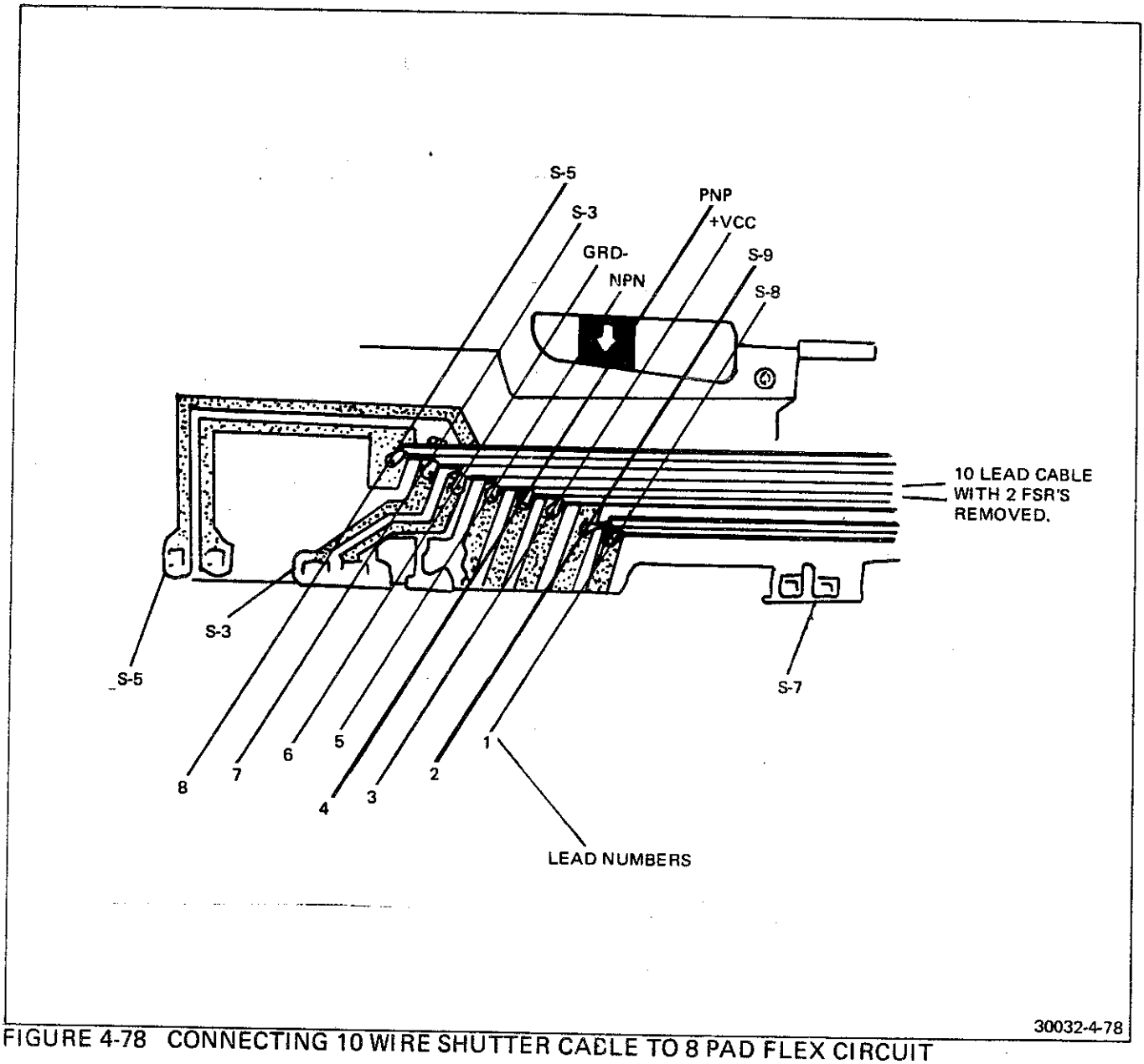


FIGURE 4-78 CONNECTING 10 WIRE SHUTTER CABLE TO 8 PAD FLEX CIRCUIT

When a camera malfunctions and the cause is isolated to a switch failure, the entire switch is replaced, with one exception. Because the body of S6 is a physical part of the inner frame, only the contacts of S6 are removed and replaced. The following paragraphs discuss all nine switches.

1. General Disassembly Procedures

In order to gain access to any of the nine switches, the camera must be partly disassembled. The following steps describe the disassembly and will not be repeated for each of the nine switches.

a. Erect the camera to picture-taking configuration.

b. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.

c. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its movement and allow the front cover to be removed.

d. Carefully peel the leather decorative cover from the bottom cover.

e. Remove the four screws from the bottom cover.

f. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.

g. Slide the cover from the assembly.

Caution: The standard method for soldering procedures involves inserting a discarded film pack to protect the film compartment. However, when disconnecting and connecting switches, there must be no power applied. Be sure to use a discarded pack in which the battery is exhausted, or insulate one battery terminal.

NOTE: When working on the switches, use only the miniature soldering iron.

2. Switch S1

S1 is the camera exposure button. It is subject to all of the usual malfunctions and is removed and replaced in the following manner:

a. When S1 fails, it is necessary to change the shutter housing. This is accomplished in the following manner:

b. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter to the bracket, and lift off the shutter.

c. Remove the two retaining screws from the upper corners at the rear of the shutter.

d. Make sure the lens is set at infinity (rotated clockwise to its stop).

e. Pry each side of the shutter housing away from the casting.

f. Remove the housing from the casting.

g. Procure a replacement shutter housing.

h. From the discarded shutter housing, remove the lens bezel by pressing the edge of the bezel from inside the housing.

i. Insert a fingernail (or a small knife blade) under the edge of the photocell bezel and snap out the bezel.

j. Press out the S1 insulator from inside the housing.

k. Install the aforementioned components on the replacement shutter housing.

1. The bezel has a large rectangular cutout in its rim. When installing the bezel, the cutout should be at approximately eight o'clock when viewed from the front of the housing.

2. At six o'clock, the bezel has a tiny locking tab. Locate this tab to align with the notch on the inside edge of the housing and press the bezel into place.

3. Install the photocell bezel. Align the three tabs with the three cutouts in the housing. Press the bezel into place.

4. Install the S1 insulator. Press the insulator into place from the outside of the housing. Use a heat-sealing tool to seal the insulator in place.

l. On the shutter assembly, rotate the lens to its clockwise stop.

m. Place the housing in position on the shutter so that the focus and trim wheels protrude through the correct slots.

n. Snap the housing onto the casting.

o. Install and tighten the two shutter-to-housing screws.

p. Check to see that the four light seals are properly in place on the hinge bracket.

q. Position the shutter on the hinge bracket and align the locating pins.

r. Install and tighten the four retaining screws. See Figure 4-79.

3. Switch S2

Switch S2 is actually a part of the flash bar socket. The contacts are actuated by the insertion of a flash bar so that the camera is automatically converted to the flash mode of operation. The switch is subject to failure caused by dirt, corrosion, wear, or abuse. If the switch is defective, the flashbar socket must be replaced. Proceed as follows:

a. Remove the shutter and remove the housing from the shutter as described in the previous paragraph.

b. Remove the two screws from the trim assembly.

c. Remove the trim-link screw and swing the trim link out of the way.

d. At the back of the substrate, unsolder the six pillar-socket connections.

e. Turn the shutter over and remove the two rivets (Figure 4-80):

1. Use a no. 38 twist drill in a pin vise and drill through the two rivets, or, if available, use Special Tool #11710 deriveter.

2. Use a suitable drift pin and push out (by hand) the rivets.

f. Lift out the pillar socket.

g. Set the replacement pillar socket into place on the shutter casting.

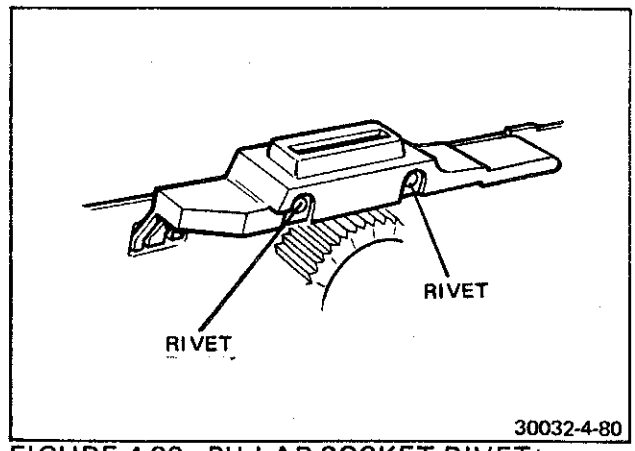


FIGURE 4-80 PILLAR SOCKET RIVET LOCATIONS

h. Insert two no. .080 x 3/8" machine screws and nuts through the casting and the socket.

i. Install a washer on each screw.

j. Apply a small amount of Loctite on the protruding end of each screw.

k. Install and tighten the two nuts.

l. Swing the trim link into position.

m. Install and tighten the trim-link screw.

n. Set the trim assembly into position on the casting.

o. Install and tighten the two screws.

p. In the back side of the substrate, solder the six pillar-socket connections.

q. Install the shutter housing on the shutter casting and secure with the two screws.

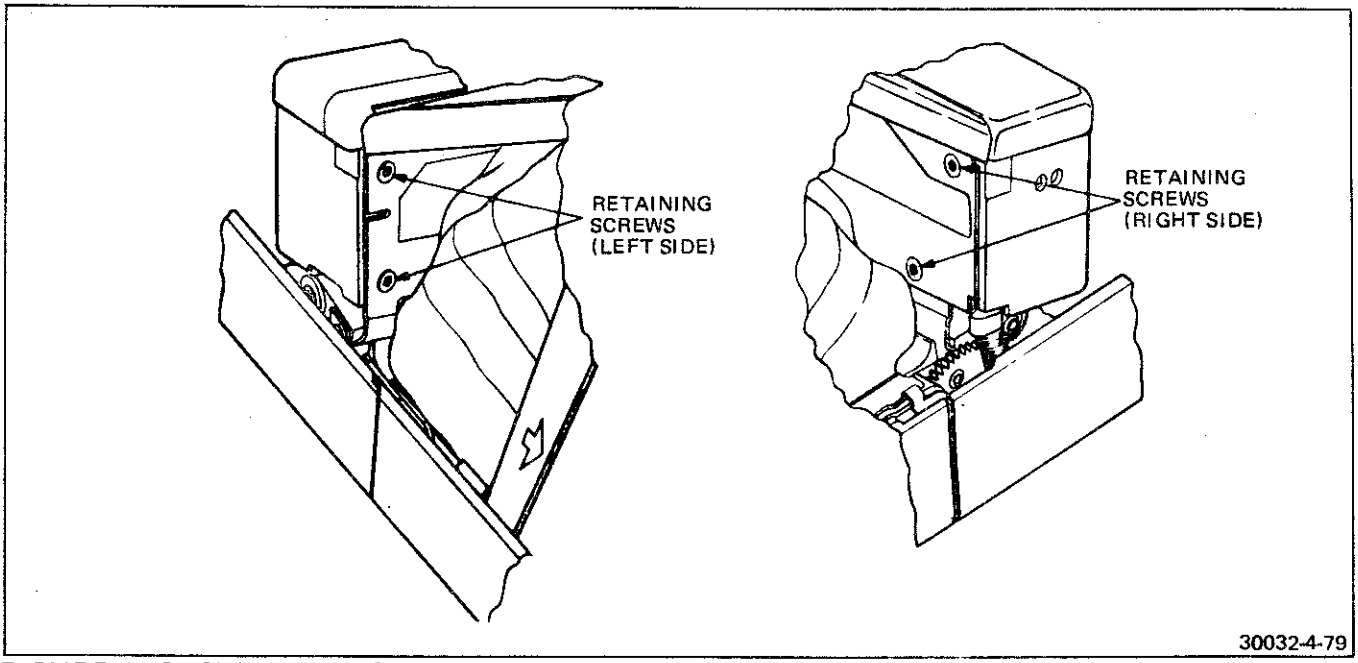


FIGURE 4-79 SHUTTER MOUNT RETAINING SCREWS

r. Position the shutter on the hinge bracket and secure with the four screws through the back side of the bracket.

4. Switch S3

Switch S3 actuates the electronic circuitry which, in turn, provides the delay between the Fresnel carrier travel and the exposure to eliminate the effects of mirror (Fresnel) bounce. The switch is mounted in the gear-train assembly and is actuated by the ram. However, the switch can be removed and replaced without removing the gear train assembly (outer plate) from the camera. Proceed as follows:

NOTE: If the camera has a Fairchild shutter, install a .047 to .1 MF polarized capacitor to prevent a switch S3 contact bounce. If the subject camera is so equipped, no further action is required. If not, connect the positive lead of the capacitor to the positive S3 contact and the negative lead to the negative contact of the S5 switch. See Figure 4-81.

a. Remove the camera bottom cover as described in paragraph 1.

b. Using the miniature soldering iron, unsolder and disconnect the tab of the flex circuit from the S3 contacts.

c. Fold the tab of the flex circuit **(Do not crease)** away from the switch contacts.

d. Refer to Figure 4-82. Remove the S3 adjusting screw. Note that a tab on the switch body rides in a slot to prevent S3 from rotating.

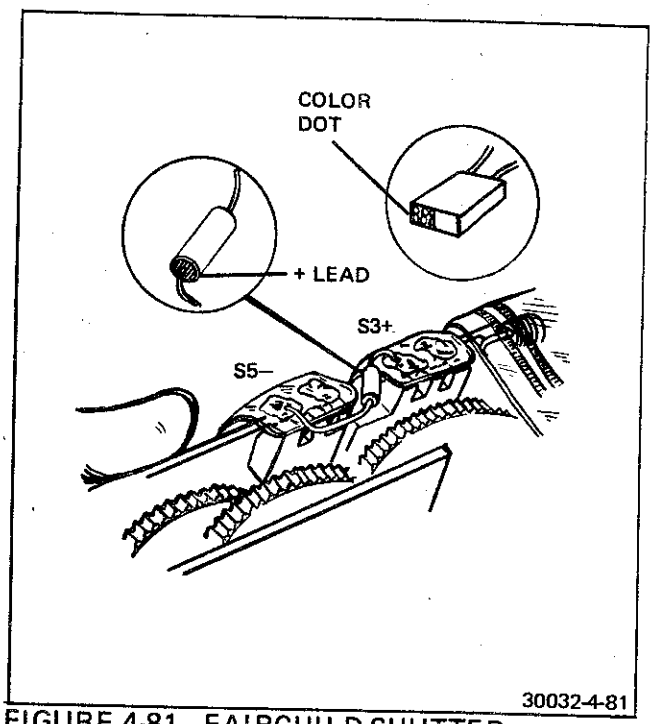


FIGURE 4-81 FAIRCHILD SHUTTER, CAPACITOR INSTALLATION

e. Using either tweezers or needle-nose pliers, grasp one of the switch contacts as close as possible to the body of the switch.

f. Insert the blade of a jeweler's screwdriver between the outer plate and the switch body. Pry the switch body away from the outer plate just enough to let the tab of the switch clear the slot in the outer plate.

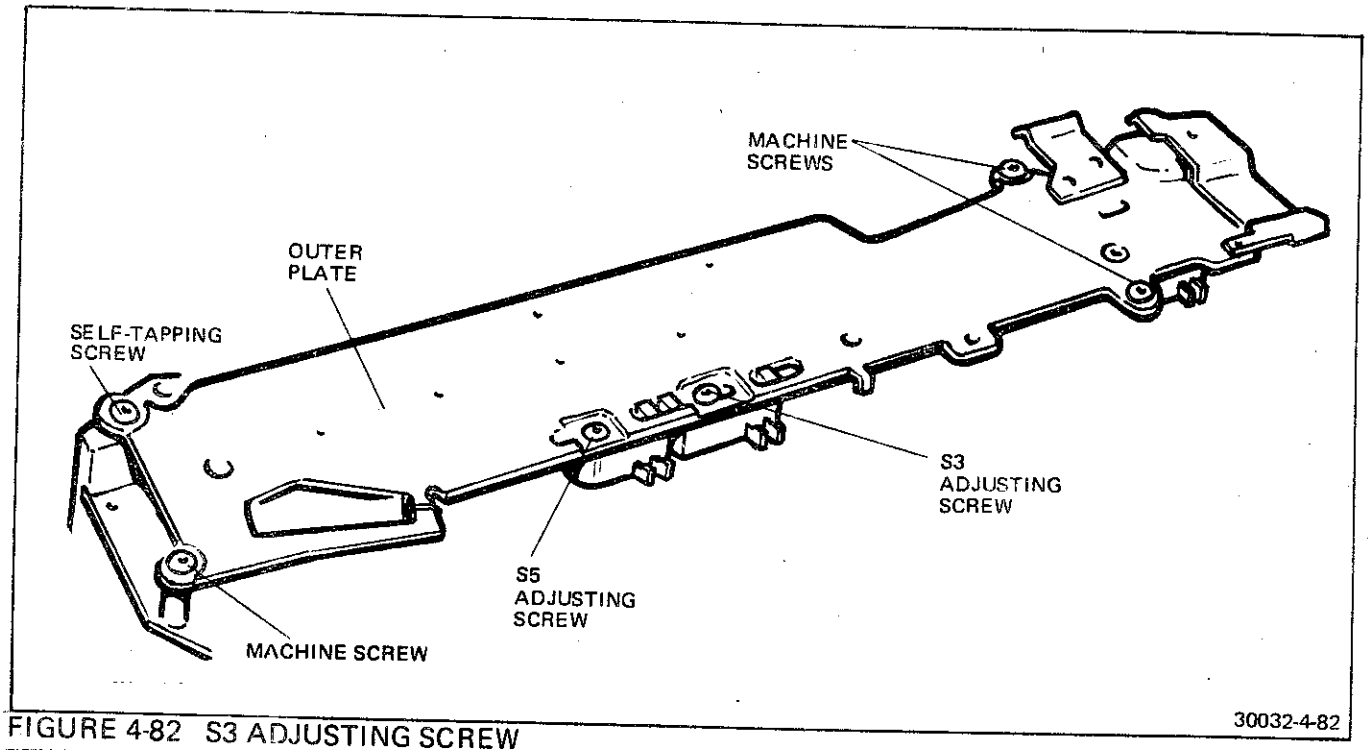


FIGURE 4-82 S3 ADJUSTING SCREW

g. Withdraw the switch.

h. To install the replacement switch, refer to Figure 4-82. Insert the switch in such a position that the arm of the contacts will be as shown on the illustration.

i. As in step f, use the jeweler's screwdriver to separate the switch body from the outer plate and provide clearance for the tab.

j. Slide the switch into position until the tab enters the slot in the outer plate.

k. Insert and tighten the screw.

l. Obtain the switch timing fixture (part of test set).

m. Perform S3 timing adjustment as described in Section III, paragraph S of this manual.

5. Switch S4

Switch S4 is an integral component of the shutter assembly. It is actuated by a pin on the plunger of Solenoid no. 1. It is subject to the same malfunctions as the other switches. The switch is a part of the Solenoid no. 1 assembly and the entire assembly must be removed in order to replace S4.

a. Remove the shutter from the camera and proceed as follows:

b. Remove the two retaining screws from the upper corners at the rear of the shutter.

c. Rotate the lens clockwise to its stop.

d. Pry each side of the housing away from the casting and remove the shutter housing from the casting.

e. Remove the two screws from the trim assembly and lift off the trim assembly.

f. Use Special Tool #11655. Remove the focus wheel retainer screw and the focus wheel pivot.

g. Remove the positive stop pin (Figure 4-83).

h. Using tweezers, reach down into the stop-pin cavity and remove the spring.

i. Remove the screw securing the trim link and lift off the trim link.

j. Remove the focus wheel stud.

k. Using tweezers, pick off the cam follower assembly (Figure 4-84).

l. Use Truarc pliers. Remove the idler gear retaining ring.

m. Remove the idler gear.

n. Turn the shutter over and unsolder the four flex circuit tab contacts. It may be necessary to remove surplus solder by means of solder-wick prior to releasing the connections.

o. Lift the flex circuit locating tab from the locating pin.

p. Insert the end of a dental pick under one of the flex circuit leads and lift the lead from its solder pad as heat is applied.

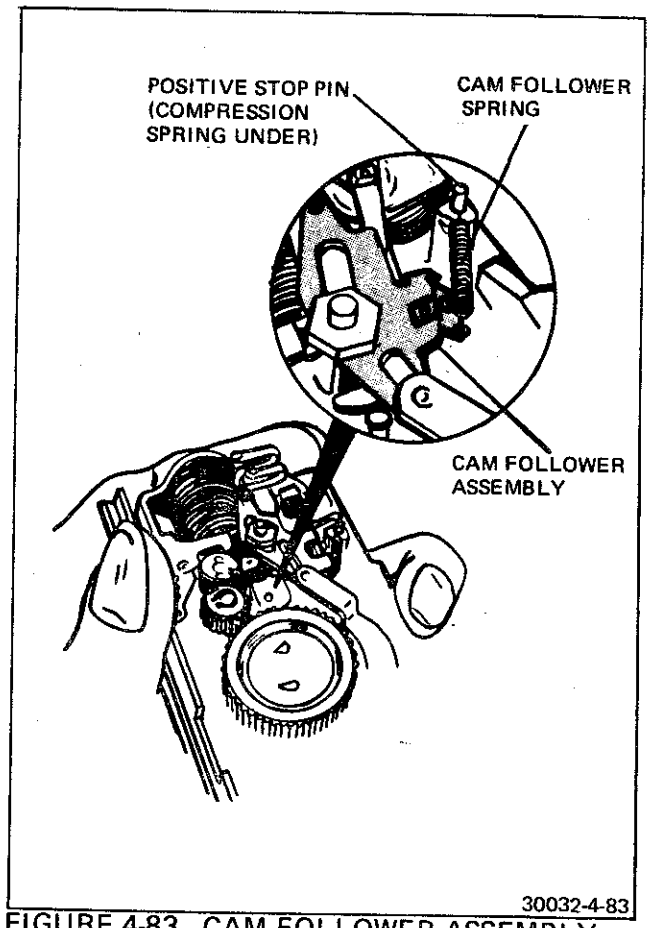


FIGURE 4-83 CAM FOLLOWER ASSEMBLY, POSITIVE STOP PIN & SPRING

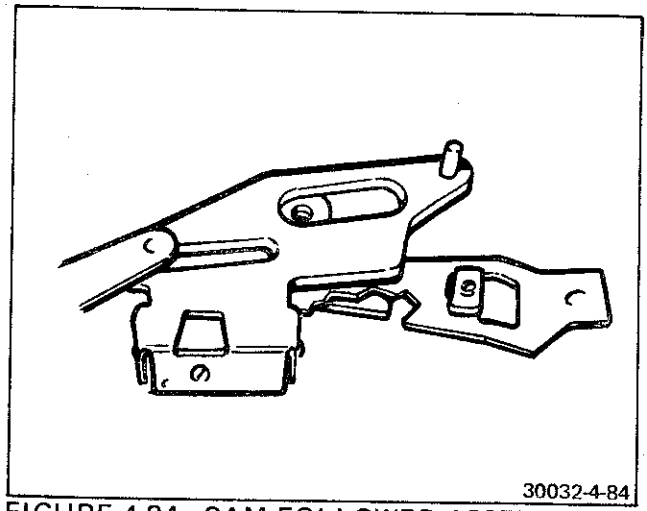


FIGURE 4-84 CAM FOLLOWER ASSEMBLY

q. Repeat the procedure for each of the remaining leads.

r. Turn the shutter over (front side up).

s. The solenoid retaining screw is under the solenoid in the bottom edge of the shutter casting. Remove the solenoid retaining screw.

t. Using tweezers, set the walking beam at the approximate center of its stroke.

u. Hold the walking beam and lift out the solenoid together with the walking beam assembly as a unit. The tab on the flex circuit must be carefully guided through the slot in the casting.

NOTE: The solenoid connections are unsoldered at the back of the shutter because, if the front connections are unsoldered, the connecting pin could drop into the shutter mechanism without being seen.

v. Procure a replacement Solenoid no. 1 assembly which will include the replacement S4 switch.

w. Thread the flex-circuit tab through the slot in the casting.

x. Using tweezers, align the shutter-blade pins with the walking beam mounting post.

y. Position the walking beam on the top of the post. While slowly moving the assembly down the post, use tweezers to align the shutter pins with the slots in the walking beam so that, when the assembly reaches the bottom of the post, the pins will be seated in the slots.

z. Using tweezers, actuate the walking beam to insure that both shutter blades move.

aa. In the bottom edge of the shutter casting, install the single screw to secure Solenoid no. 1.

ab. The cam follower assembly includes the inteceptor which must reach under the pull-down bar of Solenoid no. 2. Use tweezers and slide the interceptor under the bar. At the same time, position the cam follower so that its slot is centered over the threaded hole in the mounting post.

ac. Install the focus-wheel pivot into the threaded hole and tighten the pivot with Special Tool #11655.

ad. Using a miniature nut driver, install and tighten the trim-link standoff.

ae. Place the trim-link over the standoff and engage the pin with the slot in the cam follower (Figure 4-85).

af. Install and tighten the retaining screw in the standoff.

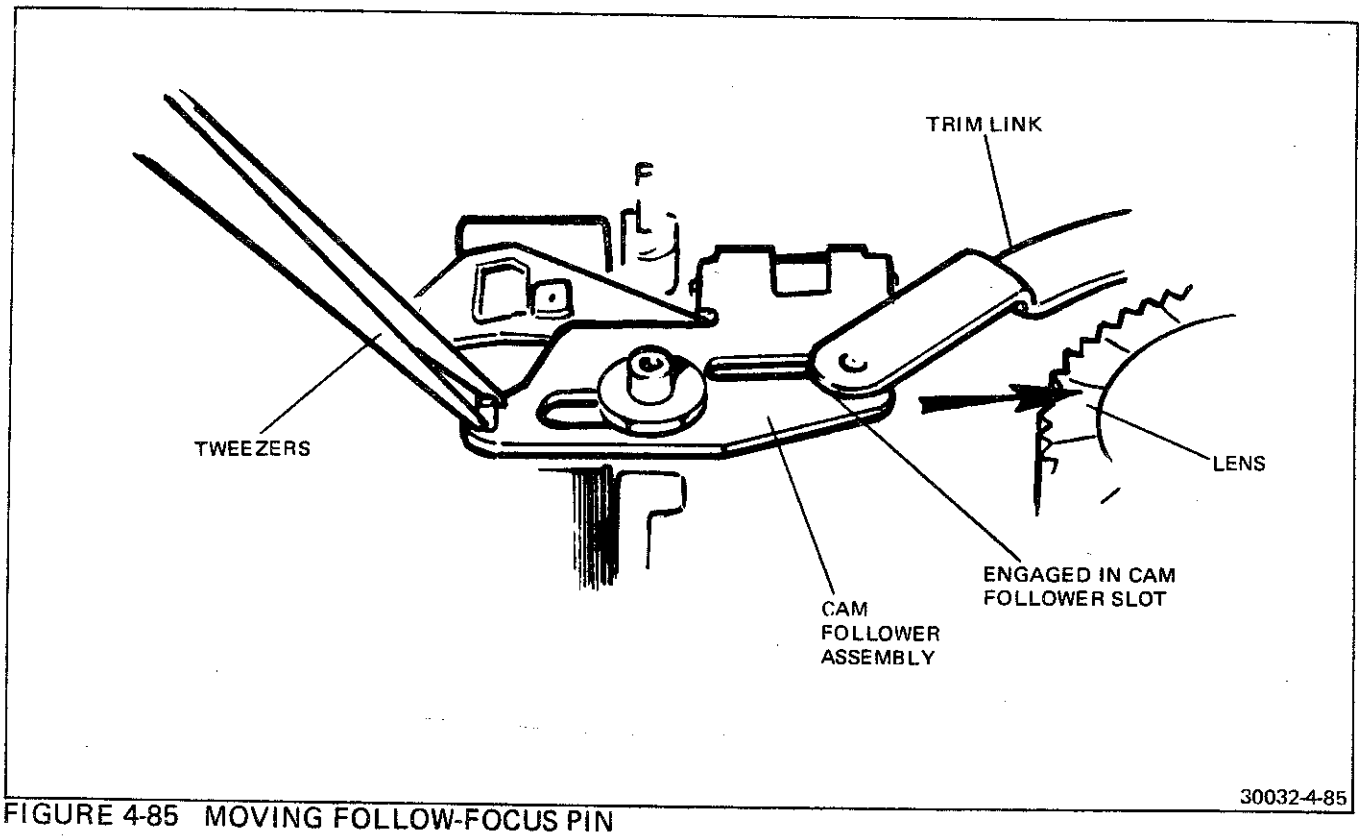


FIGURE 4-85 MOVING FOLLOW-FOCUS PIN

ag. Install the compression spring into the positive-stop-spring socket in the shutter casting.

ah. Insert the stop pin on top of the compression spring.

ai. Rotate the lens mount clockwise to its stop (infinity).

aj. Examine the bottom side of the focus wheel (Figure 4-86). Note that it has a spiral groove and two rectangular depressions. One is positioned close to the spiral groove. The positive stop pin must engage the other rectangular depression (the one farthest from the spiral groove). The pin on the cam follower must engage the spiral groove. Install the wheel so that the foregoing requirements are met.

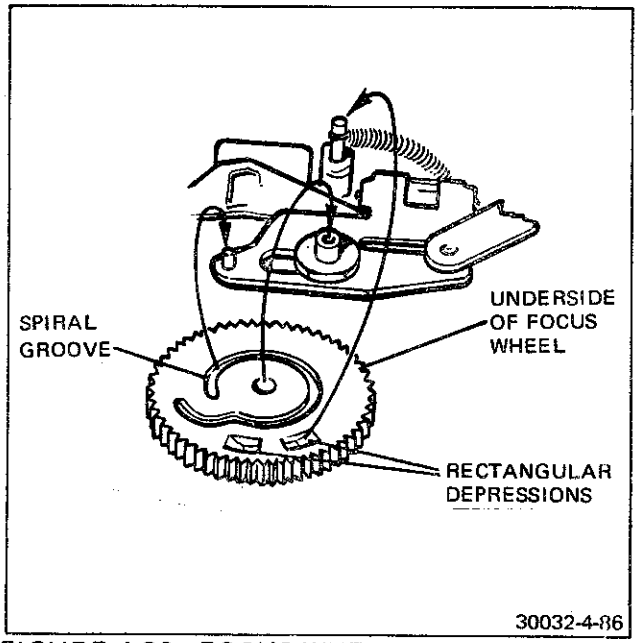


FIGURE 4-86 FOCUS WHEEL CONFIGURATION

ak. Install the hex-head focus wheel retaining screw. Use Special Tool #11655. Tighten the hex-head screw.

al. Set the trim wheel at its normal position.

am. Set the assembly on the casting so that the two locating studs enter the locating holes in the casting.

an. Check to see that the plastic stud on the trim wheel mates with the slot in the trim link.

ao. Install and tighten the two retaining screws.

ap. Check the operation of the trim wheel.

aq. Rotate the lens and the focus wheel to their clockwise stops.

ar. Install the idler gear on its post. If the idler gear was previously adjusted, it will be necessary to see that the gear teeth are all engaged. If the idler gear is new, the foregoing may not be required because the gears have not been adjusted to mesh.

NOTE: Whenever the idler gear and/or focus wheel is replaced, the lens must be collimated. See Section III, paragraph D.

as. Install the idler gear retaining ring.

at. Place the shutter housing in position on the shutter so that the focus and trim wheels protrude through the correct slots.

au. Snap the bottom of the housing over the casting.

av. Install and tighten the two shutter-to-housing screws.

aw. Check to see that the four light seals are properly in place on the hinge bracket.

ax. Position the shutter on the hinge bracket and align the locating pins.

ay. Install and tighten the four retaining screws.

az. Perform lens collimation.

6. Switch S5

Switch S5 shuts off power to the drive motor and applies dynamic braking to keep the motor from coasting. Like S3, S5 is mounted in the gear train assembly. Also like S3, S5 can be replaced without disturbing the gear train.

a. Remove the camera bottom cover as described in paragraph 1.

b. Using the miniature soldering iron, unsolder the tab of the flex circuit from the S5 contacts.

c. Fold the tab of the flex circuit **(Do not crease)** away from the switch contacts.

d. Remove the S5 adjusting screw. Note that a tang on the switch body rides in a slot in the outerplate to prevent S5 from rotating (Figure 4-87).

e. Using either tweezers or needle-nose pliers, grasp one of the switch contacts as close as possible to the body of the switch.

f. Insert the blade of a jeweler's screwdriver between the outer plate and the switch body. Pry the switch body away from the outer plate just enough to let the tab of the switch clear the slot in the outer plate.

g. Withdraw the switch.

h. To install the replacement switch refer to Figure 4-87. Insert the switch in such a position

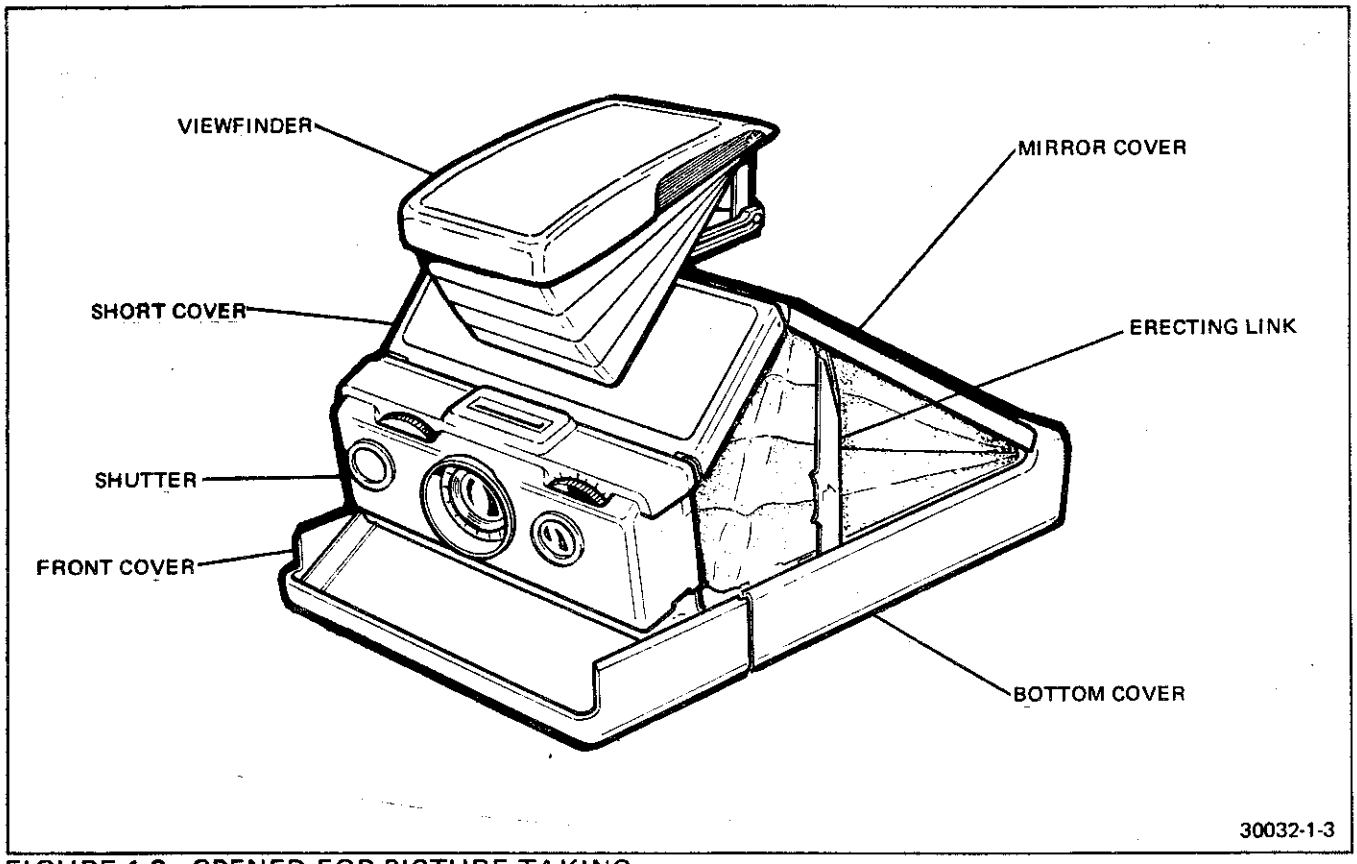


FIGURE 1-3 OPENED FOR PICTURE TAKING

The subject is viewed and focused through the taking lens, a mirror, a Fresnel viewing screen, and an optical system to focus the image at the viewing eyepiece. As in all single-lens reflex cameras, the shutter must be open to provide an image at the eyepiece. This requirement is fulfilled by the automatic electro-mechanical components which are described in detail in Section II of this manual.

When the exposure is made, the image must be transferred from the viewing system to the surface of the film in accurate focus. To accomplish this, the shutter closes and the viewing screen swings out of the optical path which is then diverted by a mirror to the film surface. These two paths are described in greater detail elsewhere in this section.

The exposure is made following the viewing screen/mirror swing. The screen then returns to the viewing position and the automatic mechanism ejects the exposed sheet of film. Development takes place outside the camera and can be observed by the operator. As soon as the print is ejected, the mechanism completes its cycle to prepare for the next exposure. Following the tenth exposure, the flash circuit ceases its exposure function until a fresh film pack is inserted. Normal operation will resume when the camera is reloaded.

B. CAMERA OPERATION

The following paragraphs describe the electromechanical events that occur in normal operation. The purpose of this description is to acquaint the reader with the manner in which the various functions are accomplished. Detailed analysis at a component/sub assembly level appears in Section II.

1. Opening the Camera

When the SX-70 is folded, an interlock switch (S6) removes all battery power from the camera mechanism to prevent any drain from the film-pack-encapsulated batteries. To prepare the camera for picture taking, hold the camera in the left hand, pull straight up on the serrated portion of the viewfinder housing (Figure 1-2). This action releases latches, which, in turn, allow the main body of the camera to raise into operating position.

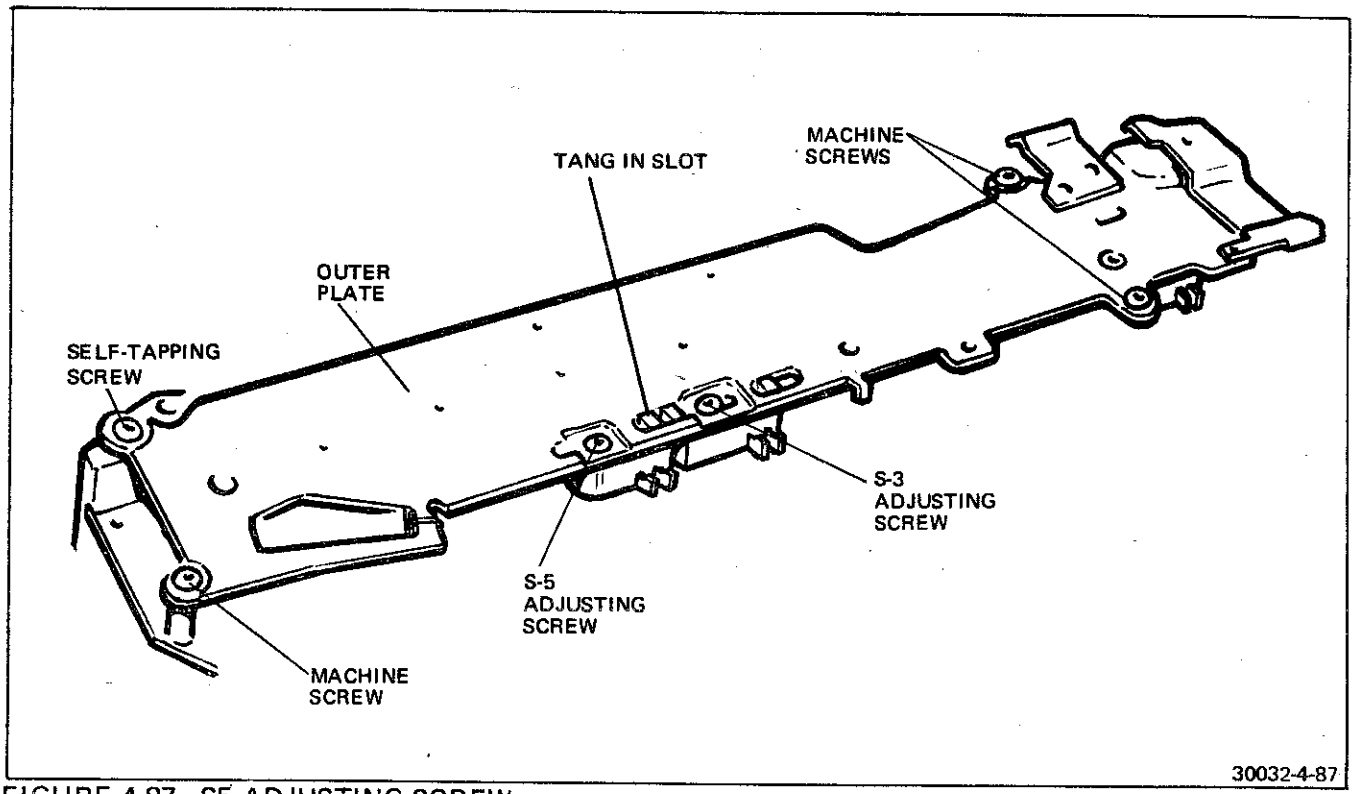


FIGURE 4-87 S5 ADJUSTING SCREW

that the contact arms will be as shown on the illustration.

i. As in step f, use the jeweler's screwdriver to separate the switch body from the outer plate and provide clearance for the tab.

j. Slide the switch into position until the tab enters the slot in the outer plate.

k. Insert and tighten the screw.

l. Obtain the switch timing fixture (part of test set).

m. Adjust S5 timing as described in Section III, paragraph S.

7. Switch S6

Switch S6 performs an interlock function. It disconnects the battery from the camera circuitry when the camera is closed. Like any other electrical switch, the contacts of switch S6 are subject to the accumulation of dirt and corrosion. Over a period of use, the contacts become subject to fatigue and breakage. In addition, a contact that has become loose on the housing can cause camera malfunction. If any of the aforementioned causes result in a camera malfunction, the contacts must be either tightened on their mount or replaced. The following paragraphs describe the removal and replacement procedures.

a. Remove bottom cover as described in paragraph 1.

b. Unsolder and disconnect the two S6 contacts (Figure 4-88).

c. Fold back but **do not crease** the two S6 contacts of the flex circuit.

d. Use a sharp Xacto knife. Shave off the top of the two plastic studs which secure one of the contacts. Lift off and discard the contact.

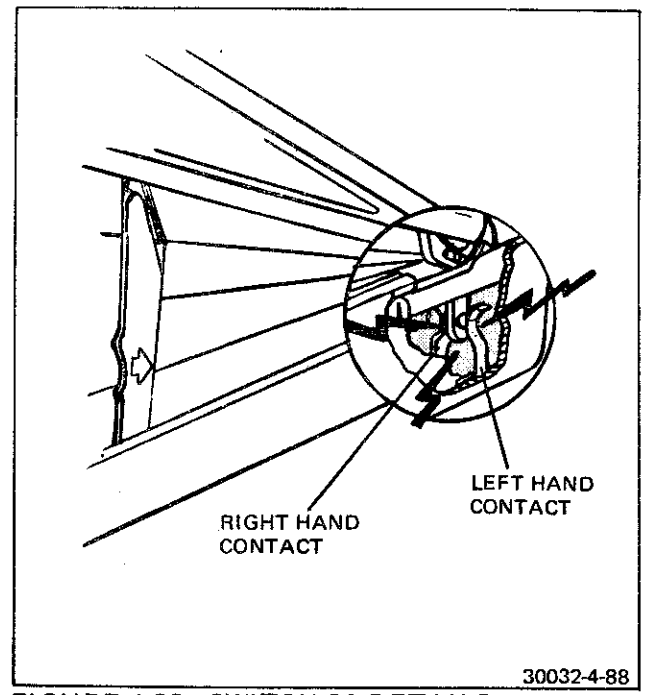


FIGURE 4-88 SWITCH S6 DETAILS

e. Obtain the correct replacement contact. The contacts are designated R.H. and L.H. The contact nearest the edge of the camera is the L.H. contact.

f. Position the new contact over the remaining portion of the two retaining studs. Use tweezers or other suitable tool and press the contact down firmly on the studs. The top surface of the studs should be flush with the surface of the contact.

g. Use a sharp scratch awl or any suitable sharp-pointed tool. In the exact center of the plastic stud, make a small locating hole.

h. Use a pin vise with a no. 62 twist drill and drill the contact support boss to a depth of 1/4 inch.

i. Use a pin vise and a 00-96 tap and thread the hole.

j. Install and tighten a 00-96 x 3/32 fillister-head screw.

k. In the same manner, install a screw in the second plastic stud.

l. Replace the other S6 contact in the same manner.

m. Use a V.O.M. on the OHMS X1 scale and check the resistance across the S6 contacts. When the camera is open, S6 should be closed indicating zero ohms. When the camera is closed, the switch should be open indicating infinity.

n. When the switch is functioning correctly, proceed to reassemble the camera.

o. Position the tab of the flex circuit over the S6 contacts. Span one of the contacts with the tips of tweezers and press the circuit over the contacts so that the contact protrudes through the solder pad of the flex circuit.

p. Repeat the procedure for the second contact.

q. Complete the reassembly of the camera.

8. Switch S7

Switch S7 provides the interlock function for the front (film loading) cover. When the cover is open for loading film, battery power is removed from the camera electrical circuits. S7 is subject to all the failure modes associated with the other switches and when it malfunctions it must be removed and replaced. The following steps describe the correct procedure.

a. Disassemble the camera as described in paragraph 1.

b. Using the miniature soldering iron, unsolder and remove the flex circuit from the S7 contacts.

c. Bend back but **do not crease** the tab of the flex circuit to provide access to the switch.

d. Remove the S7 retaining screw.

e. Loosen the two forward gear-train (outer plate) retaining screws **no more than three turns**. This is done to permit the stud on the S7 switch body to clear the locating hole in the outer plate (Figure 4-89).

f. Remove the S7 retaining screw.

g. Using tweezers, grasp the lower switch contact as close as possible to the body of the switch and lift out the switch.

h. To install the replacement switch, grasp the contact as in step f and slide the switch into position.

i. Install the retaining screw.

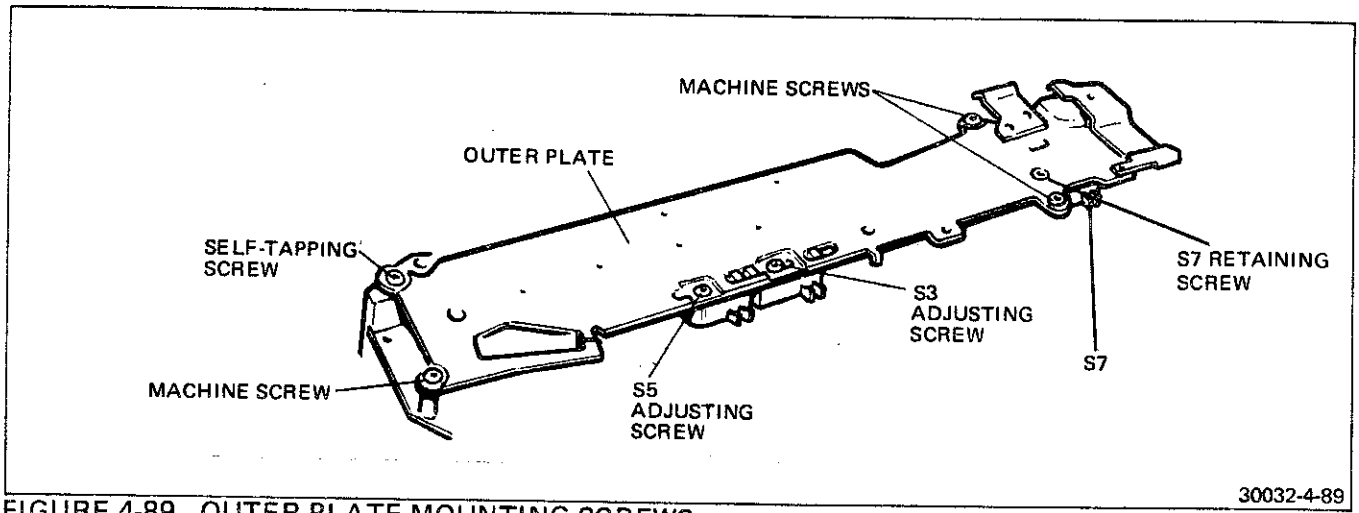


FIGURE 4-89 OUTER PLATE MOUNTING SCREWS

j. Tighten the two gear-train (outer plate) retaining screws.

k. Locate the tab of the flex circuit over the two switch contacts.

l. Span one of the contacts with the tips of the tweezers and press the flex down firmly so that the contact protrudes through the solder pad of the flex circuit.

m. Using the miniature soldering iron, solder the two switch contacts.

n. Reassemble and check the camera.

9. Switch S8

Switch S8 initiates the initial camera cycle when a film pack is inserted and the front cover is closed. It is subject to all of the failures common to the other switches in the camera.

Switch S8 in an integral part of the counter assembly. To remove and replace switch S8, refer to the replacement procedures for the counter assembly.

10. Switch S9

Switch S9 notifies the camera circuitry that the film pack has been exhausted. The camera mechanism will still function but the flash circuits are inhibited. It is subject to all of the failures common to the other switches in the camera.

Switch S9 is an integral part of the counter assembly. To remove and replace switch S9, refer to the replacement procedures for the counter assembly.

AA. GEAR TRAIN, REMOVE

The gear train assembly provides the motive power for all of the camera automation. Any malfunction in the gear train will render the camera inoperative. It is possible for a gear tooth (or teeth) to be broken, in which case, proper timing would be lost. Two of the gears are equipped with cam surfaces which are subject to wear although damage to the cams is unlikely. If the recock ram is worn or distorted or if the rivet that secures the ram is loose the gear train must be removed and replaced.

Procedure for removing a broken, bent or malfunctioning front cover latch, without dismantling gear train is as follows:

1. Remove the two screws: (Figure 4-90). The first is a machine screw on which the latch pivots.

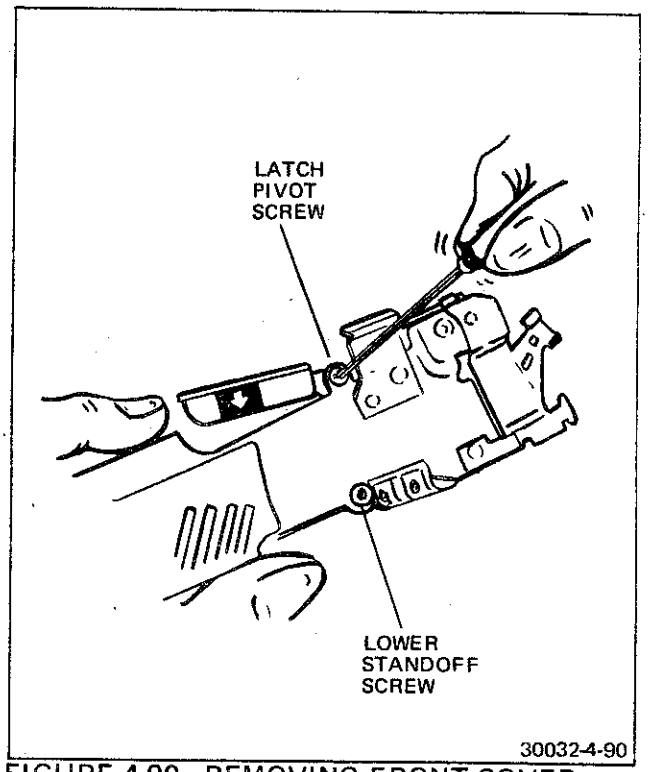


FIGURE 4-90 REMOVING FRONT COVER LATCH

2. Remove a second screw from the lower standoff on the bottom of the outerplate.

3. Use a notched jeweler's screwdriver, push the latch spring end down and toward the gears to free it from the clip.

4. Move the latch and at the same time note where the latch engages the small S7 actuator cam.

5. Place thumb under the outer plate on the front of the gear train assembly; spring the assembly slightly away from the bottom plate.

6. When the outer plate is separated from the side, wiggle the spring and latch off its pin.

7. Set camera down on the gear train to prevent gear train from falling out; if one or more gear teeth disengage, timing will be incorrect. In this event the gear train must be completely disassembled and rebuilt on the timing fixture.

Testing and fault analysis will indicate a possible malfunction in the gear train assembly. If removal and replacement is indicated follow the procedures described in the following paragraphs.

1. Erect the camera to picture-taking configuration.

2. Open the front cover by depressing the front cover release latch on the right side of the camera bed.

3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-

train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.

4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In this step the bottom cover will be removed. To prevent damage to the flex-circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Lift off the gear train cover.
9. Insert an empty film pack, with one battery terminal insulated to prevent electrical continuity. Using a solder remover remove the solder from switch contacts S3, S5 and S7. See Figure 4-91. In many cases, removing the solder will completely free the flex circuit connections. Use tweezers and a soldering iron, heat the connection and lift off the flex with tweezers. Do not unsolder any other connections at this time. Use a lifting and twisting motion to free contacts from the flex circuit. On FAIRCHILD shutter installations observe the capacitor polarity.

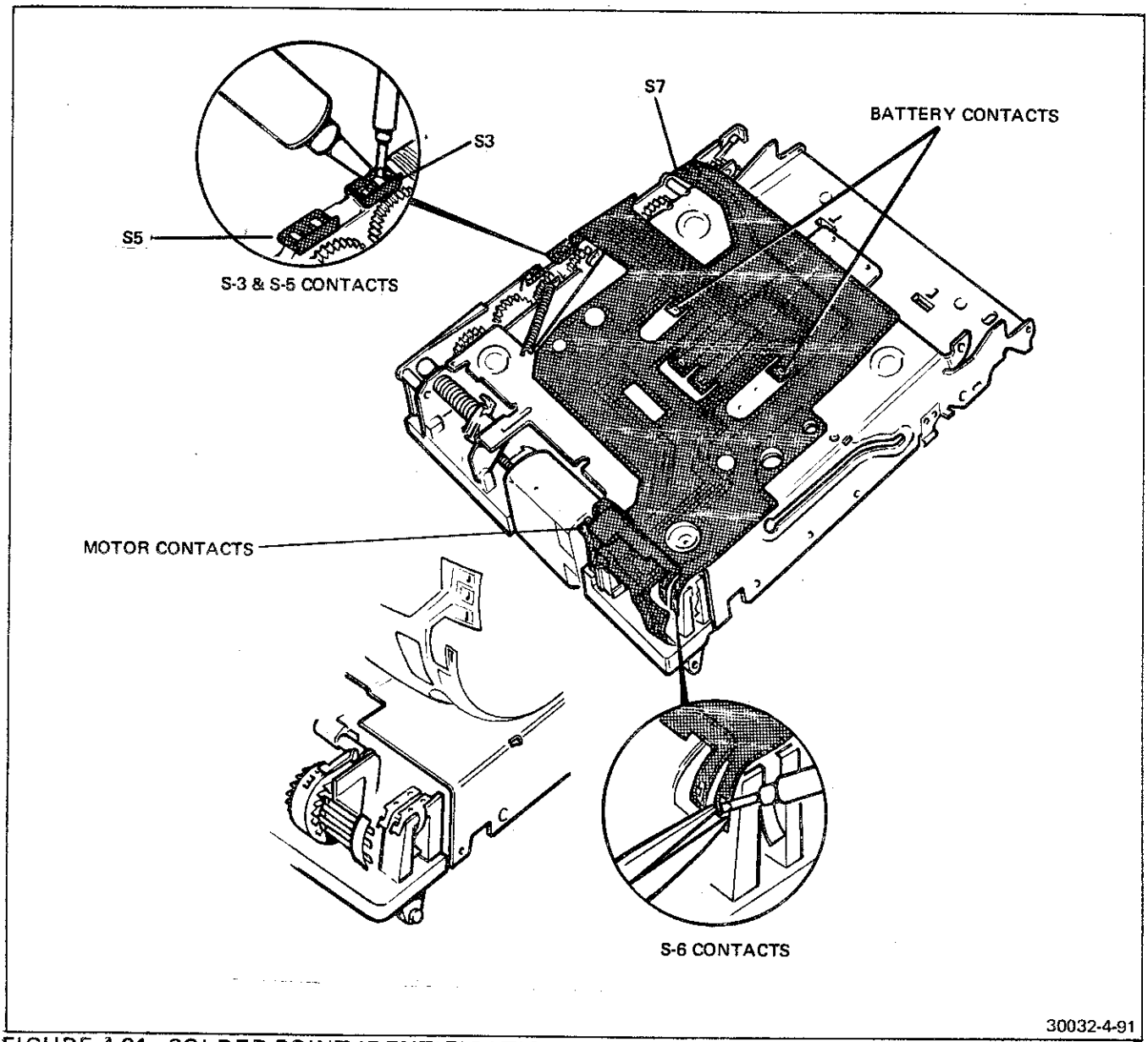


FIGURE 4-91 SOLDER POINT IDENTIFICATION

10. Use a pair of needle-nose pliers and open the multi-wire cable clamp just sufficiently to release the cable. Unhook the cable retaining spring.

11. Refer to Figure 4-92. Use Special Tool # 11680 to catch the end of the booster spring. Stretch the spring just enough to unhook the end of the spring from the outer plate.

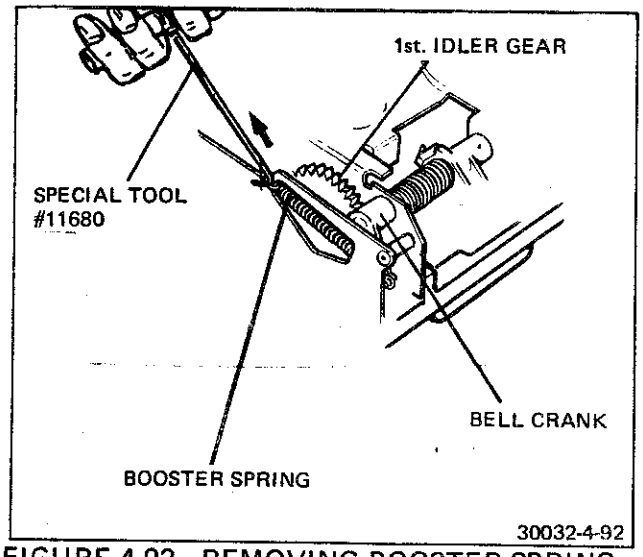


FIGURE 4-92 REMOVING BOOSTER SPRING

12. Refer to Figure 4-93. Use Special Tool # 11680 or tweezers and remove the two override springs.

13. Using tweezers, unhook the safety latch actuator leg of the single-loop safety latch spring.

14. Refer to Figure 4-94. Use tweezers and slip the hooked end of the Fresnel carrier drive spring off its retainer on the drag link bell crank. Free it from the lug of the overdrive spring.

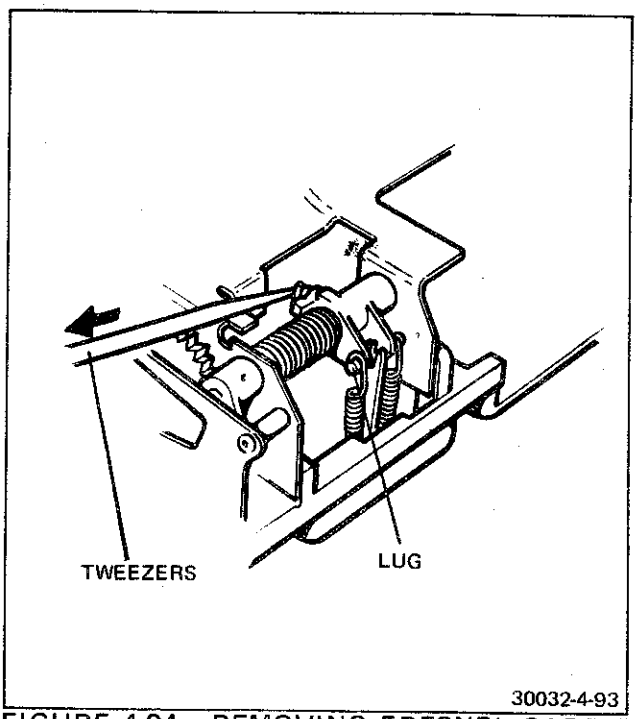


FIGURE 4-94 REMOVING FRESNEL CARRIER DRIVE SPRING

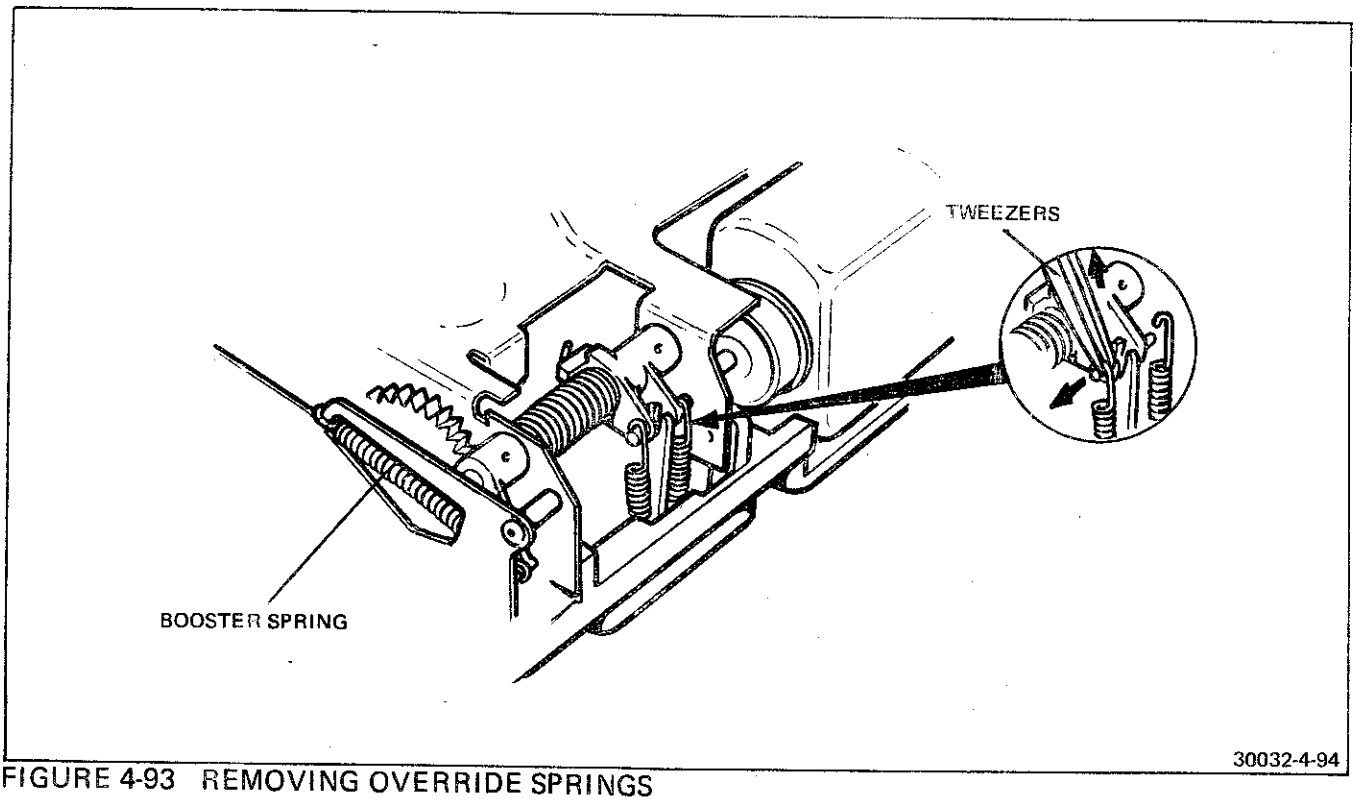


FIGURE 4-93 REMOVING OVERRIDE SPRINGS

15. Refer to Figure 4-95. Remove the four outer plate (gear train assembly) mounting screws. Note that three are machine screws but the fourth is a self-tapping screw.
16. Invert the camera so that the outer plate (gear train) is on the bottom.

    NOTE: If the gear train is being removed for other than gear damage or faulty timing it may be unnecessary to retime the gear train. For this reason, try not to disturb the gears when performing the following steps.
17. Peel away the flex circuit from the outer plate and grasp the gear train in such a manner that the front cover latch is depressed and pull the gear train down and away from the camera.
18. If the gear train is faulty, remove all the gears.
19. Remove the front-cover latch together with its spring.

AB. GEAR TRAIN, INSTALL

1. Determine which of the components must be replaced, secure replacement components as necessary and proceed to reassemble the gear train in the following manner.

   Caution: The interrelationship of all gear-train components is critical to correct automation sequencing. Do not deviate from the correct timing procedure.
2. Obtain the special timing fixture, Special Tool # 318368. Withdraw both slides to their stops, and raise the lever to its uppermost position.
3. Refer to Figure 4-96. Place the outer plate (gear train assembly) in position on the fixture as shown.
4. Secure the outer plate to the fixture by sliding the slide lock all the way to its stop.
5. Refer to Figure 4-97. Identify the recock gear. This component has a metal cam heat-staked to one side of the gear.
6. With the cam side down, place the gear on post no. 2 (Figure 4-96). Pull out the end of the fixture tension spring sufficiently to allow the gear to drop all the way down on the post.
7. Manually rotate the gear in the couterclockwise direction until the flat area of the cam is stopped by the end of the slide lock. Make sure that the gear is held in this position by the fixture tension spring.
8. Identify the separating washer, Figure 4-97. Place the washer on post no. 2 over the recock gear.
9. Identify the second idler gear, Figure 4-97. This gear has an integrally molded cam on one side. Place this gear, cam surface uppermost, on pin no. 2 over the washer.

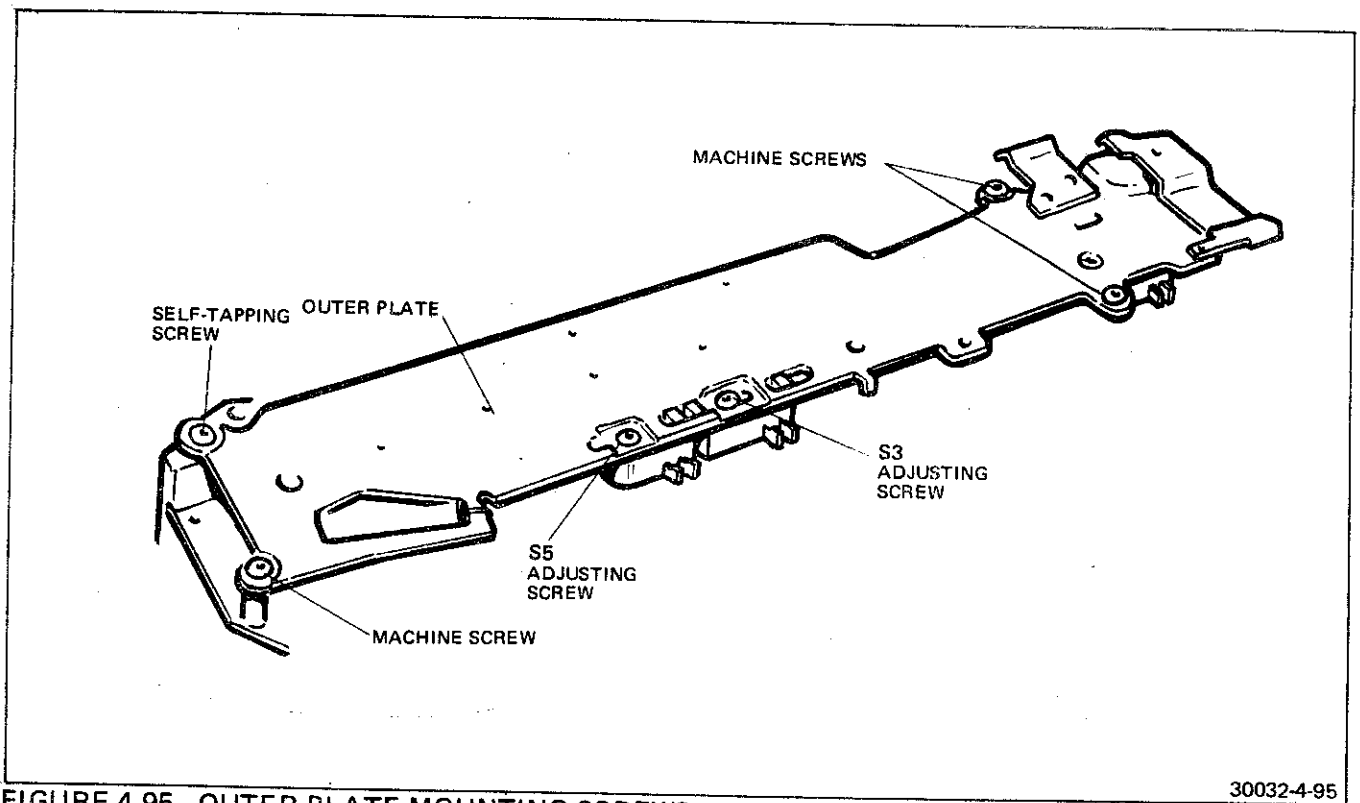


FIGURE 4-95 OUTER PLATE MOUNTING SCREWS

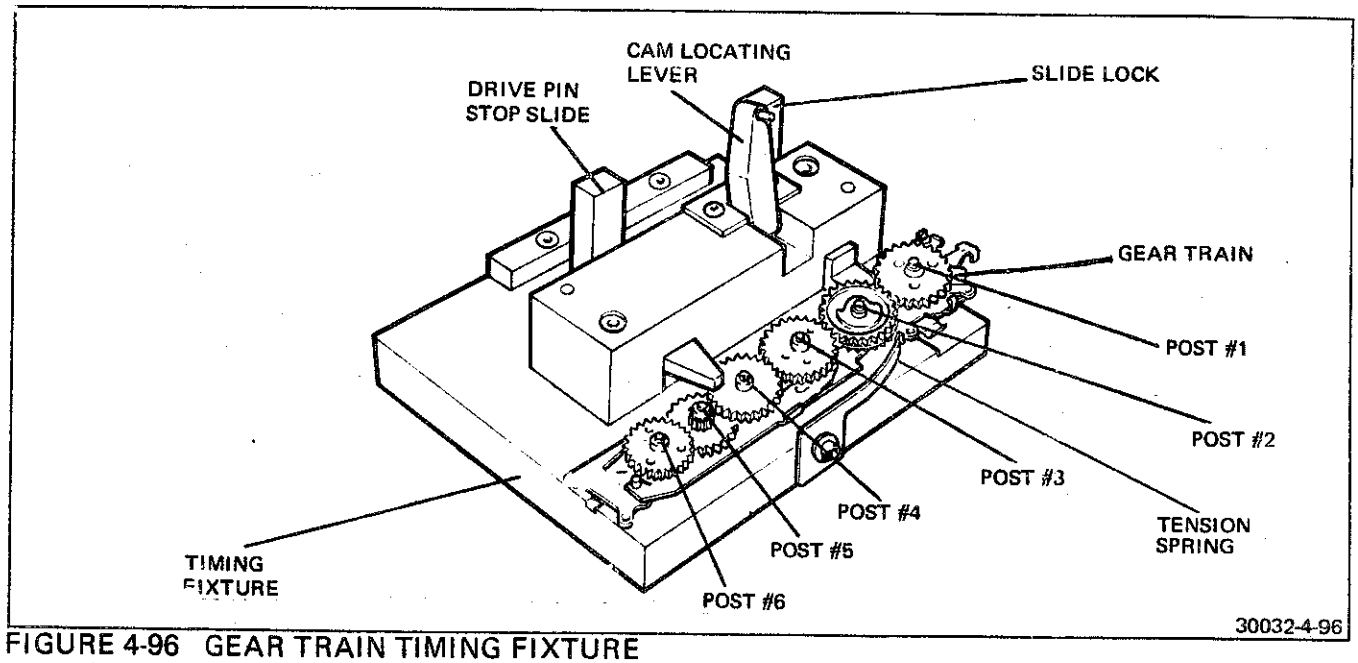


FIGURE 4-96 GEAR TRAIN TIMING FIXTURE

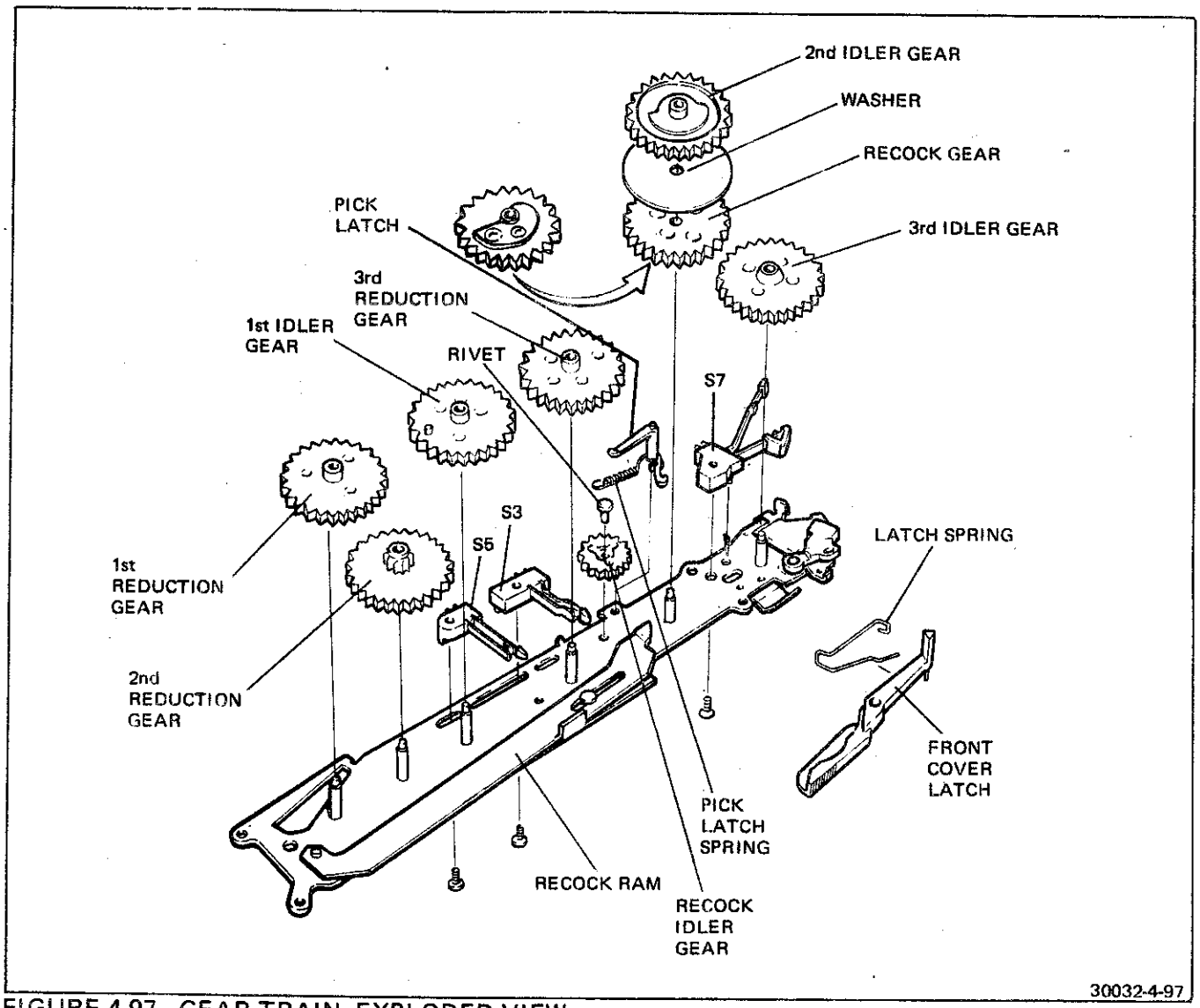


FIGURE 4-97 GEAR TRAIN, EXPLODED VIEW

Caution: When performing the following step, observe the recock gear underneath the washer and be sure its position is not disturbed.

10. On the timing fixture swing down the cam locating lever so that the pin on the lever touches the molded cam surface. The lever should swing freely and the pin should contact the cam by virtue of the weight of the lever. Carefully rotate the gear clockwise until the pin drops into the recess of the cam. Continue rotating the gear clockwise until the pin meets the shoulder of the cam.
11. Identify the 3rd idler gear (Figure 4-97). This gear has a beveled hub on one side.
12. Apply finger pressure to hold the 2nd idler gear in its correct position. With the beveled hub uppermost, place the 3rd idler gear on post no. no. 1.
13. Identify the 2nd reduction gear (Figure 4-97). This gear has three mold cavities equally spaced at 120 degrees on the side opposite the small-diameter spur gear.
14. Place the gear with the small spur gear uppermost on post no. 5.
15. On the outer plate (gear train assembly) locate the recock ram. See Figure 4-97. Swing the ram toward the edge of the timing fixture to make sure that the 2nd reduction gear bottoms correctly on the post.
16. Identify the first reduction gear (Figure 4-92). This gear is a gray/green color.
17. With the small spur gear on the underside place the first reduction gear on post no. 6. The teeth of the small spur gear underneath must mesh with the teeth on the outside of the gear on post no. 5.
18. Identify the first idler gear (Figure 4-97). This gear has a small stud near its outer diameter, and this stud operates the pick slide.
19. On the timing fixture make sure that the drive pin stop slide (Figure 4-96) is in the fully withdrawn position.
20. With the small stud facing upward place the first idler gear on post no. 4.
21. Slide the drive pin stop slide (on the timing fixture) in as far as it will go and hold it in this position.
22. Rotate the first idler gear in the clockwise direction until the small stud on the gear's upper surface meets the end of the drive pin stop slide. (The small stud is the drive pin). Hold the slide tightly to make sure that the pin does not move the slide.
23. The third reduction gear is the remaining gear to be installed.
24. Refer to Figure 4-98. Orient the fixture with the gear train in place so that the gear train is on the far side of the fixture. Place the left thumb against the stop slide. With the tip of the third finger drive the second idler gear, clockwise, firmly to its stop. This is the second gear from the left with the fixture placed just

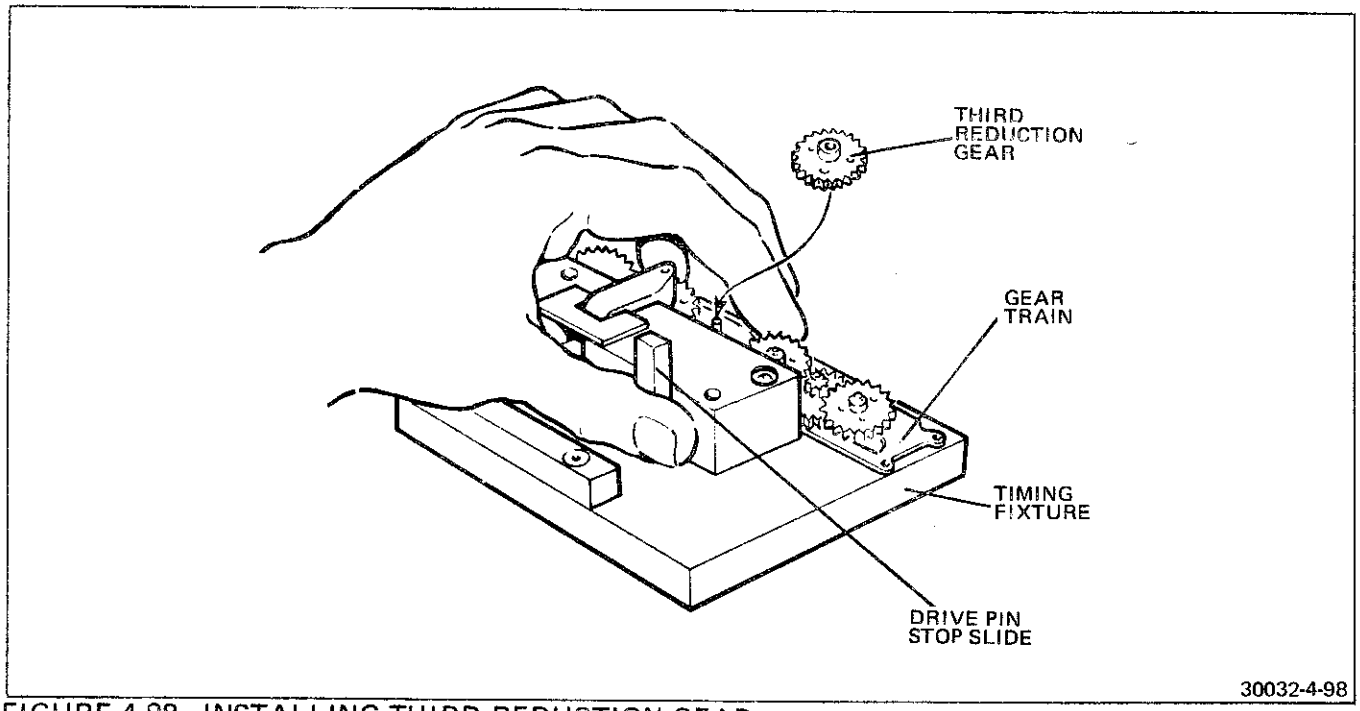


FIGURE 4-98 INSTALLING THIRD REDUCTION GEAR

as described. Hold this gear securely in this position. Place the tip of the second finger against the first idler gear and rotate the gear (in the clockwise direction) tightly against the stop. Holding these three items securely, pick up the remaining gear by its hub and drop it into place on post no. 4. With spur gear down make sure that the teeth of all three gears are engaged before releasing the gears and the slide.

25. Holding all gears down, swing up the cam locating lever and withdraw the two slides of the fixture.

    NOTE: Once the slides are released make sure that none of the gears become disengaged. If this happens, the foregoing procedures must be repeated.

26. With the tip of the right thumb, release the fixture tension spring from the gear train.
27. Grasp the gear train at the left end and carefully raise that end just far enough to clear the fixture tension spring.
28. Move the right hand to the right end of the gear train and lift the gear train free of the fixture.
29. Being careful to see that the gears do not become disengaged, rotate the gears until the small stud (drive pin) on the first idler gear is centered between the two terminals of S5. See Figure 4-97.
30. Install a rubber band lengthwise around the gear-train assembly.
31. Identify the pick latch spring.
32. Place the pick latch spring on the pick latch and install the short, hooked end of the pick latch under the recock idler gear (Figure 4-99).
33. Place pivot in the hole of the outer plate, hold the latch in the pivot hole and slip the hooked end of the spring over the retaining lug.
34. See Figure 4-100. Identify the front cover latch spring.
35. Install the latch spring on the latch.
36. On the gear train assembly identify the S7 cam actuator. Insert the S7 cam actuator pin (Figure 4-100) into the cam actuator (Figure 4-102).
37. Slip the latch over the upper standoff. Insure that the outer plate is flush on the brass standoffs. Insert screw through hole in latch into standoff and tighten.
38. Use a pick, push the S7 cam actuator to check latch operation; make certain that the gear pins are tightly secured in their pivot holes.

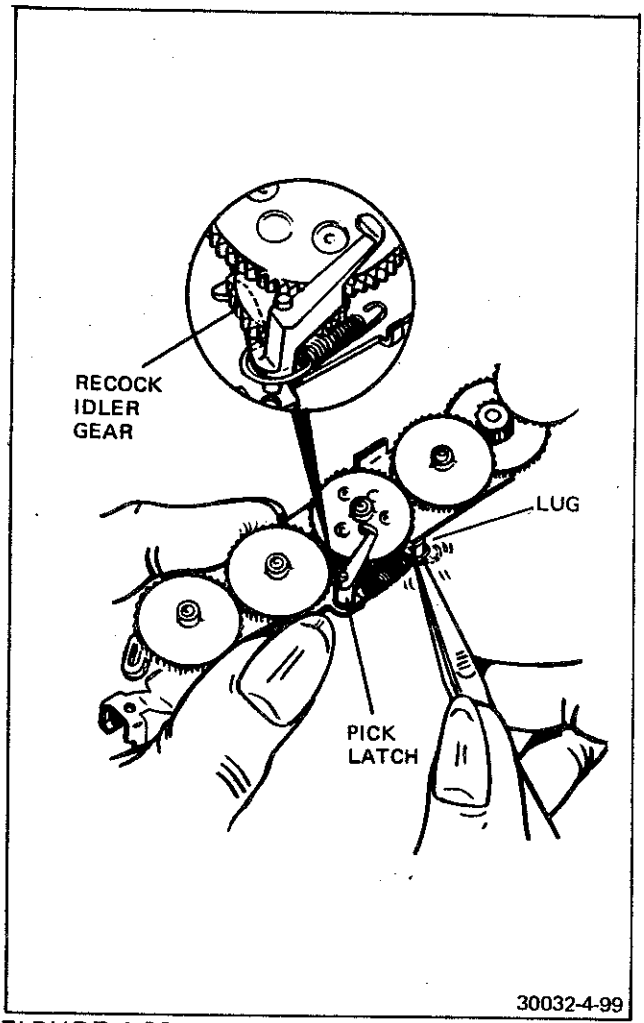


FIGURE 4-99 INSTALLING THE PICK LATCH

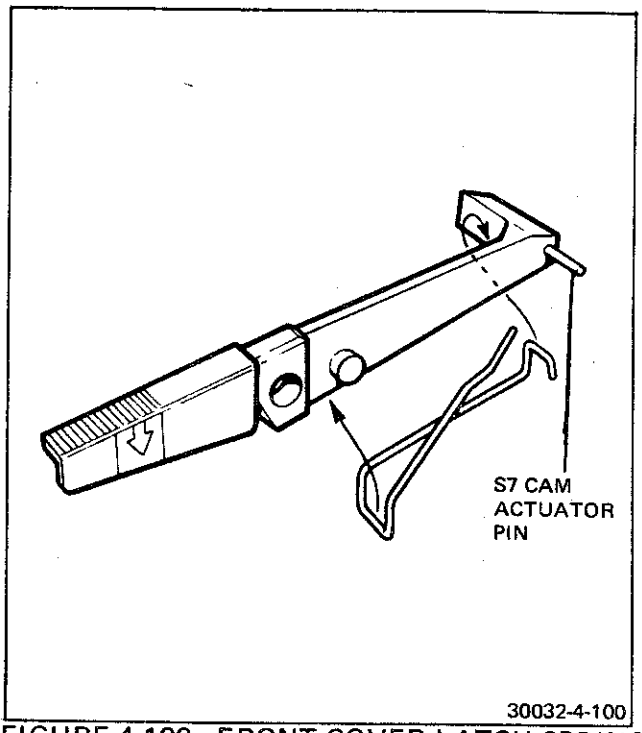


FIGURE 4-100 FRONT COVER LATCH SPRING

39. Replace the outer plate mounting screws (Figure 4-101).

40. Use notched screw driver and slide ends of latch spring under the clip on the outer plate (Figure 4-102).

NOTE: Improved safety latches have been supplied. Always install the new models.

41. Position the end of the recock ram so that the stud on the end of the ram is centered over the hole in the outer plate.

42. Position the bell crank on the camera bottom plate so that the hole in the bell crank is centered over the motor drive gear.

43. On the camera bottom plate position the safety latch so that the stop of the latch is at the right-hand end of its slot.

44. Turn the gear assembly over. Prior to mating the gear train with the camera, use tweezers and align the stud on the recock ram with the hole in the outer plate.

45. Raise the two assemblies to eye level so that both mating surfaces can be observed. Engage the hole in the bell crank with stud of the recock ram.

46. Hold the gear train and the camera body tightly together. They **must not be allowed to separate.**

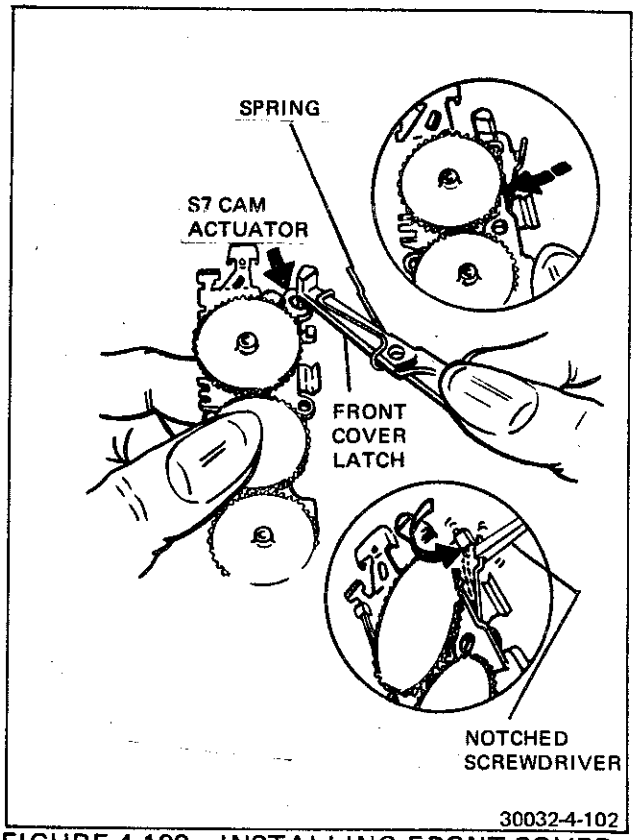


FIGURE 4-102 INSTALLING FRONT COVER LATCH & SPRING

47. Maintaining a steady pressure against the gear train assembly, use a dental pick and relocate the pick latch so that the pick-latch pivots drop into their pivot holes.

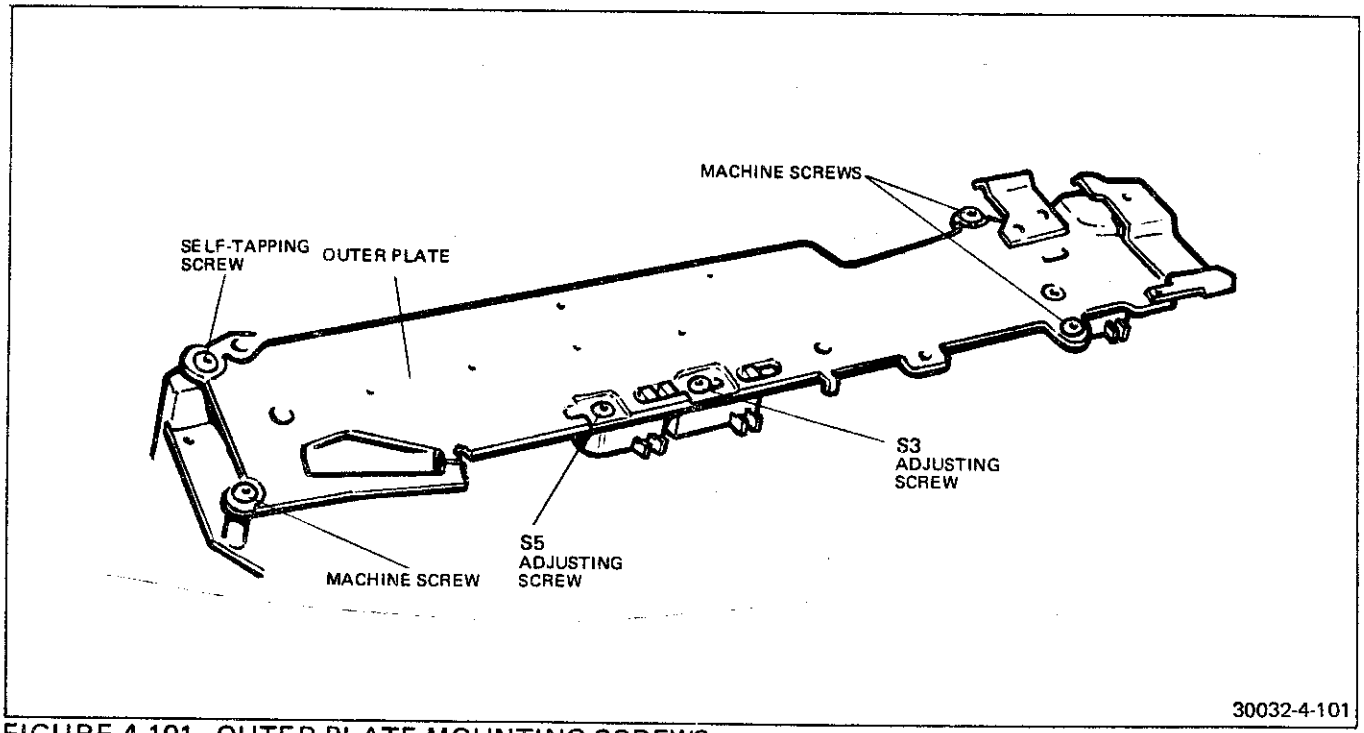


FIGURE 4-101 OUTER PLATE MOUNTING SCREWS

When the camera is fully opened, the interlock switch (S6), located at the left rear corner of the mirror cover, is closed and the battery is connected to the camera electrical circuitry (Figure 1-4).

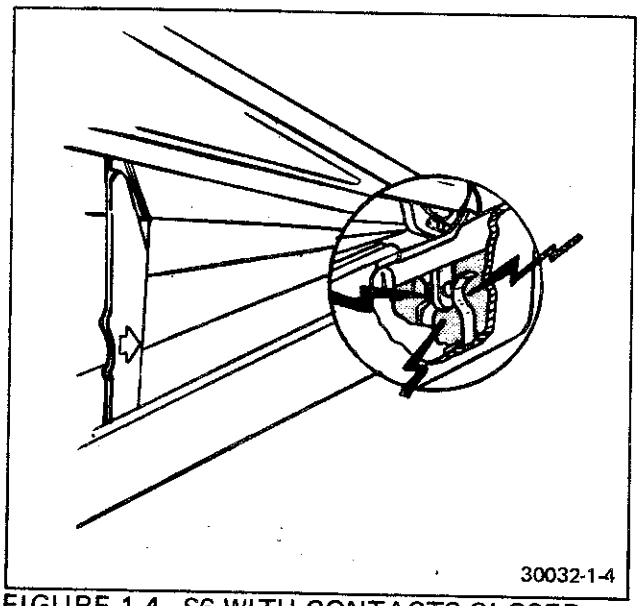


FIGURE 1-4 S6 WITH CONTACTS CLOSED

2. Loading the Film Pack

The front cover latch is located on the right side of the camera just inside the rim of the bottom cover assembly. Pressing down on this yellow latch releases the front cover which drops down to expose the film chamber. With the cover open, a film pack can be inserted or an exhausted pack can be removed.

A fresh film pack is loaded into the film chamber observing color coding (Figure 1-5). Under certain circumstances a partially used pack could be inserted, but this action will cause some deviation in the normal sequence. These deviations will be discussed at the end of this description.

The battery is a part of each film pack, and the two exposed terminals on the pack engage two contacts within the film chamber as the pack is inserted.

3. Starting the Automatic Mechanism

With the film pack in place, the front cover can be closed. It must be fully closed and latched.

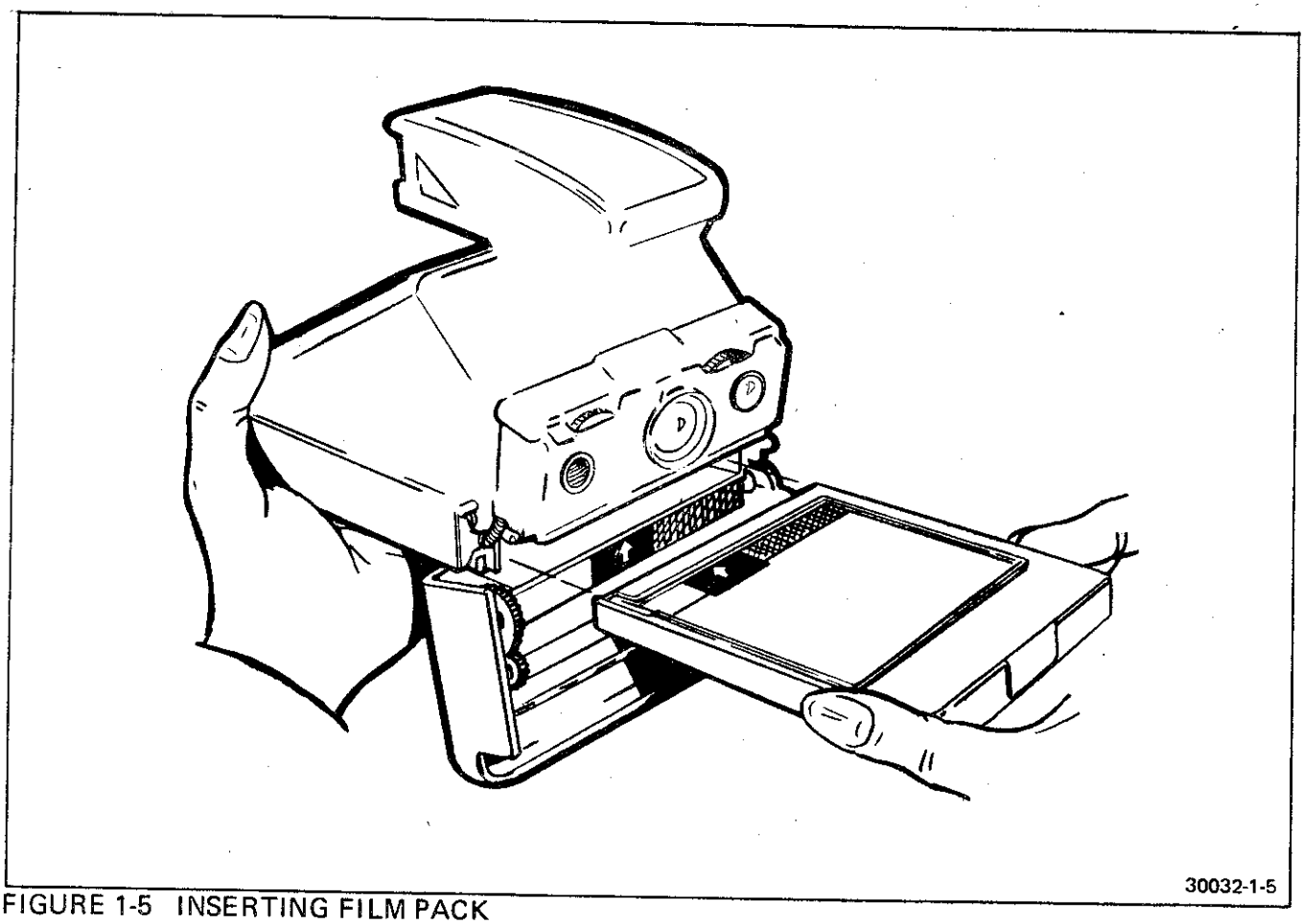


FIGURE 1-5 INSERTING FILM PACK

48. Using the dental pick, locate the safety latch actuator in the proper place on the second idler cam.

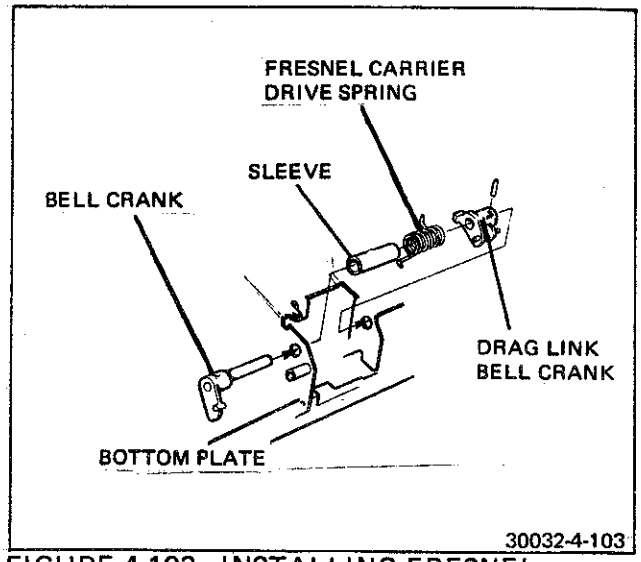


FIGURE 4-103 INSTALLING FRESNEL CARRIER DRIVE SPRING

49. Gently rock the gear train from side to side until all the gear pivot posts fall correctly into their pivot holes. When all pivots are correctly aligned the plate will seat solidly and permit no further rocking action.

50. Refer to Figure 4-101. Install but do not tighten the three machine screws and the self-tapping screw. Install a white spacer inside the outer plate at the self-tapping screw location.

51. Cut and remove the rubber band.

52. Tighten the four screws.

53. Engage the hook on the end of the Fresnel-carrier drive spring with the notched blade of the modified jeweler's screwdriver. See Figure 4-103.

54. Tension the fresnel drive spring and hook it onto its retaining stud on the bell crank.

55. Use a notched screwdriver to push down on the hooked end of the spring.

56. Hold the end of the spring down and at the same time reach under with the hook of the Special Tool # 11680. See Figure 4-104.

57. Twist the hook, catch the end of the spring and pull it out.

58. Bring the end of the spring up, over and around until the screwdriver notch can recapture the spring.

59. Repeat the same procedure until the spring is properly tensioned and secure it on the bell crank retaining stud.

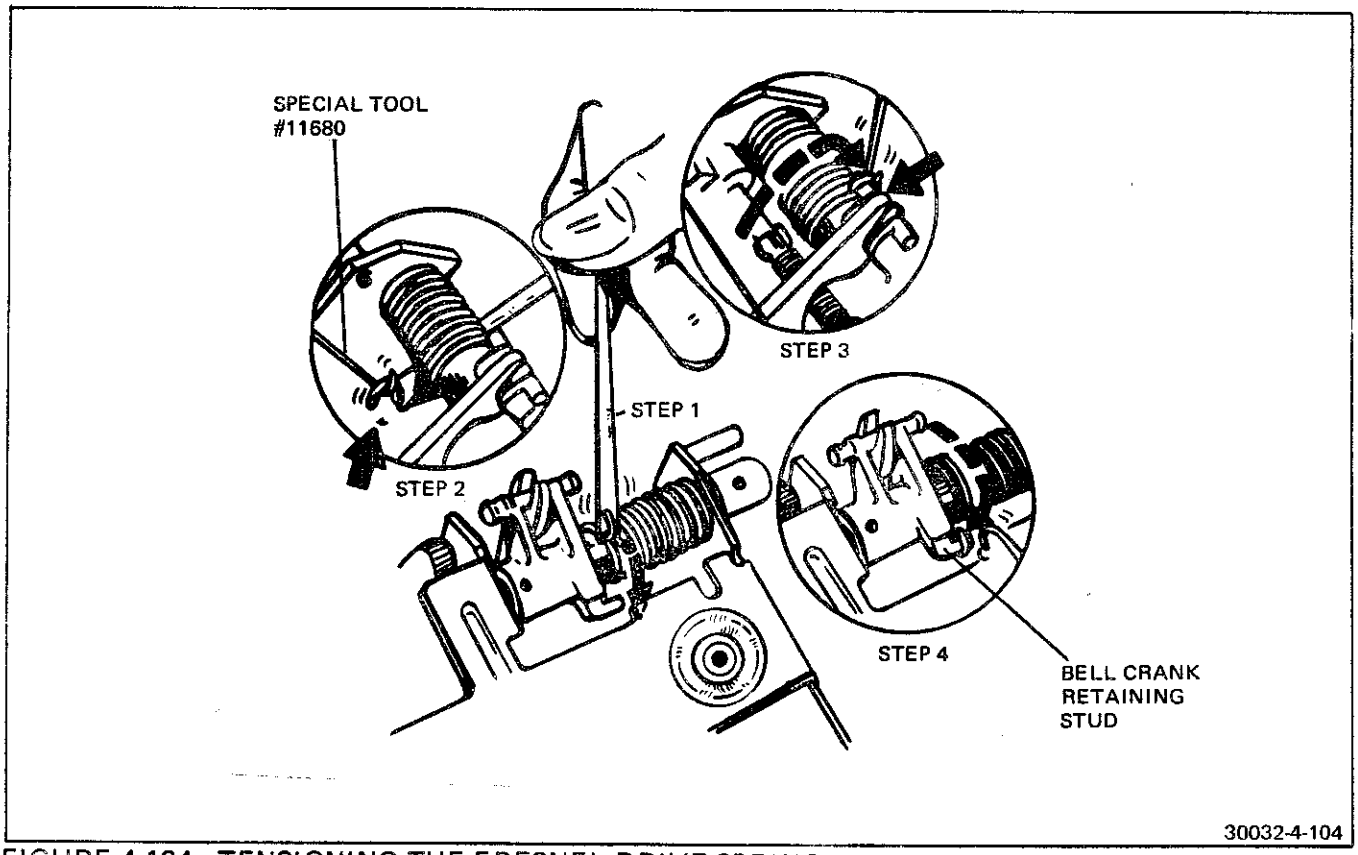


FIGURE 4-104 TENSIONING THE FRESNEL DRIVE SPRING

Follow the steps, in order, as shown in the drawing, Figure 4-104.

60. With needle-nose pliers, grasp one of the override springs at its longer extension. Hook the smaller loop of the spring over one of the arms of the T-shaped draglink and into the groove in the arm.
61. Hook the long spring extension into the corresponding groove in the arm of the bellcrank.
62. In the same manner, install the second spring.
63. Check the draglink. It should be engaged with the draglink bellcrank. If not, use needle-nose pliers and engage the draglink.
64. Rotate the second reduction gear in the counterclockwise direction until the Fresnel carrier springs up to its exposure position.
65. The booster spring has one long hooked end. Hold the spring so that the open loop is toward the top of the camera. Slip the loop through the space provided and engage the loop on the stud of the bellcrank.
66. Using Special Tool #11680, pull the end of the spring down and fasten the hook of the spring on the anchor point.
67. Rotate the second reduction gear in the counterclockwise direction until the pick slide returns to its start position.
68. Identify the safety latch actuator spring. Use tweezers and insert the left end of the spring under the tab provided.
69. Engage the other end of the spring on the safety latch actuator.
70. By rotating the second reduction gear in the counterclockwise direction, operate the gear train through one complete cycle to check proper operation of the system.
71. Install the cable spring in the cable retainer in such a manner that the end of the spring enters the hole provided.
72. Crimp the retainer over the spring with just enough pressure to capture the spring.
73. Position the flex circuit over the S3, S5 and S7 contacts. Span one of the contacts with the tips of tweezers and press the circuit over the contacts so that the contact protrudes through the solder pad of the flex circuit. Repeat this procedure for the remaining S3, S5, and S7 contacts.
74. Form the flex circuit so that it will not make contact with the gears.
75. Solder all the contacts. If Fairchild shutter type, replace the capacitor.
76. Prepare a piece of double-faced tape, 1-1/2 by 3/8 inches. Apply the tape to the camera body at the point where the ribbon cable meets the flex circuit. Make certain that no tape will extend beyond the edges of the flex circuit.
77. Fold the flex circuit over the edge of the frame. Make sure that the end of the flex circuit is parallel to the edge of the frame.
78. Press the flex circuit into contact with the tape to secure the flex circuit to the frame.
79. Install the gear-train cover and cable decal.
80. Check camera for proper operation.
81. Slide the bottom cover into place.
82. Install and tighten the four cover-retaining screws.
83. Squeeze the sides of the front cover just enough to engage the pivot points.
84. Close the camera and reinstall the leather on the bottom cover.
85. Check the camera.

AC. FRONT COVER SPREAD-ROLL ASSEMBLY, REMOVE

The spread rolls in the SX-70 camera are gear driven by the main gear train. Thus, in addition to wear or damage to the rolls, it is possible to encounter wear and/or damage to the drive gears. Regardless of the nature of the malfunction the complete assembly must be replaced. The following paragraphs describe the replacement procedure.

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. This will release the front cover. Inspect and clean the rollers and gears with a Q-tip moistened in water. If film developer is observed under the light shield or in the film catcher spring area the front cover housing must be replaced.
4. If necessary, as described above, replace the front cover housing and test.
5. If only the spread-roll assembly is to be removed, take out two screws which secure the spread rollers to the inside of the front cover, and remove.

AD. FRONT COVER SPREAD-ROLL ASSEMBLY, INSTALL

1. Position the spread-roll assembly in the front cover so that the gears will mate with the main gear train when the cover is in place.
2. Install and tighten the two retaining screws. Replace the front cover housing and test.
3. Install the decorative leather covering. Make sure the film exit is not covered by the leather.
4. Squeeze the sides of the front cover just enough to engage the pivot points.
5. Close the cover and check the camera for proper operation.

AE. SHUTTER COMPONENTS, REMOVE

NOTE: See introduction for special data on FAIRCHILD shutters.

Paragraphs AG and AH describe a total disassembly and rebuilding of the shutter assembly. In most repair situations a complete strip of the shutter will not be required. Instructions for specific repairs are given for each individual requirement in separate paragraphs following paragraph AH. The only reasons for removing the substrate would be to replace a bad substrate or to gain access to the lens/shutter blade assembly.

Caution: A failure mode caused by a static charge on a loose shutter has been encountered. Before removing a shutter from a camera, note the current drawn at the end of a cycle. It must be zero. If not, it could be an indication that the PNP transistor on the substrate has failed by not being turned off.

P type shutters have the following new features: 1) 7 lead cable; 2) TI type new fiberglass substrate; 3) Ambient exposure does not inhibit flash; 4) S4A/S4B connection reversed; 5) New drive on Sol 1; 6) Blade speed adjustment on Sol 1; 7) 'E' rings on focus wheel and follow focus assembly; 8) New return spring on follow focus cam. Some Fairchild P configuration shutters do not have item 3.

NOTE: During the follow focus test, Section III, paragraph L, step 10 does not apply: **do not** *block light from the photocell with a 'P' shutter.*

To completely disassemble the shutter, proceed as follows:

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Carefully peel the decorative leather covering from the bottom cover.
5. Remove the four screws from the bottom cover.
6. In this step the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.

   Caution: When the shutter retaining screws are removed, the shutter will remain attached to the camera by the ribbon cable. Use care to avoid damage to the cable.

8. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter to the bracket. See Figure 4-105. Lift off the shutter.

   NOTE: New Fairchild printed circuit substrates are not insulated and may short out on the original shutter hinge bracket, part no. 705297. To prevent this, remove the 3 shock mount pads on the bracket and replace them with a 2 piece shock mount, numbers 705894 and 705892.

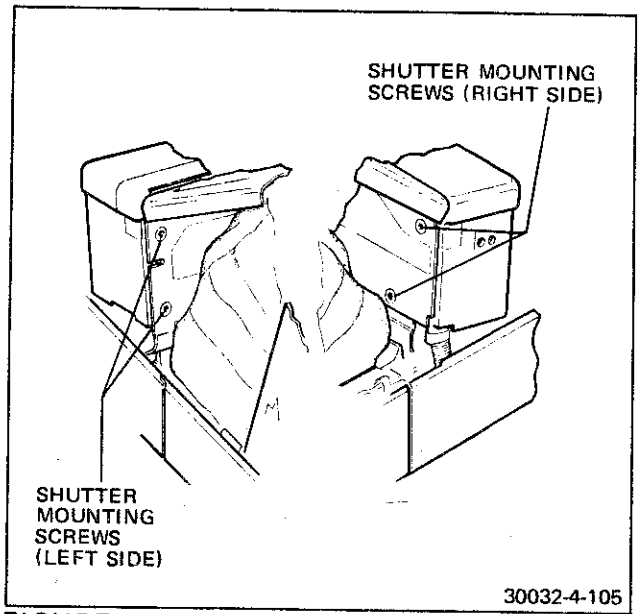


FIGURE 4-105 SHUTTER MOUNTING SCREWS

Or, replace the entire shutter bracket with the new type no. 705893. Check drawing no. 4-105A and Configuration Control, Section V of the manual.

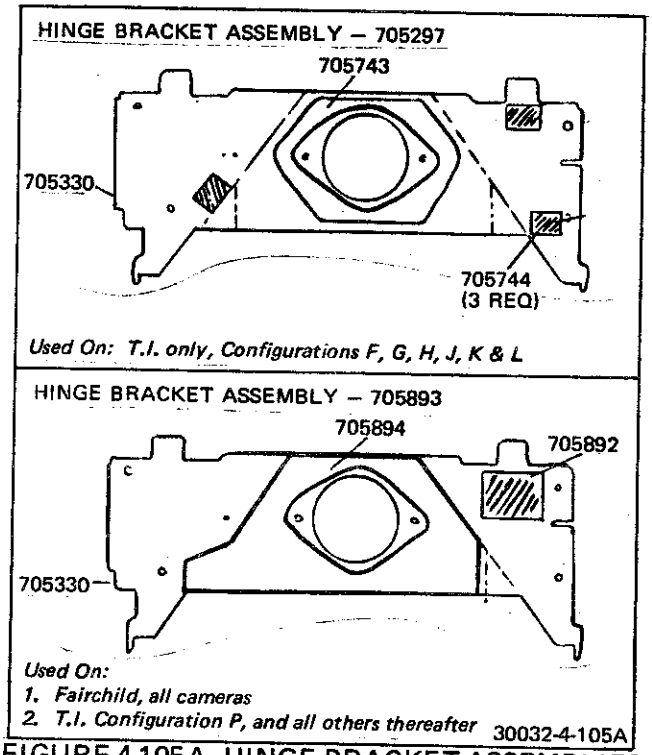


FIGURE 4-105A HINGE BRACKET ASSEMBLIES

9. Remove the two retaining screws from the upper corners at the rear of the shutter.
10. Make sure the lens is set at infinity (rotated clockwise to its stop).
11. Pry each side of the housing away from the casting.
12. Remove the shutter housing from the casting.
13. Place the shutter casting on the hinge bracket and install one of the four retaining screws.

NOTE: A change in the lighten-darken TRIM WHEEL ASSEMBLY overcomes erratic action of the assembly. The cam on the light shield of the Front Cover has been made wider and deeper and the tang of the trim reset lever (shutter) is now a flat bar about 1/16 of an inch wide and appears off center. It is seen as a brass color and also flat black. All replacement shutters will be the new type. The improved shutter will also have a cut out area larger and square in shape than the older version (Figure 4-106).

When a new shutter is installed, the cam in the light shield must be changed.

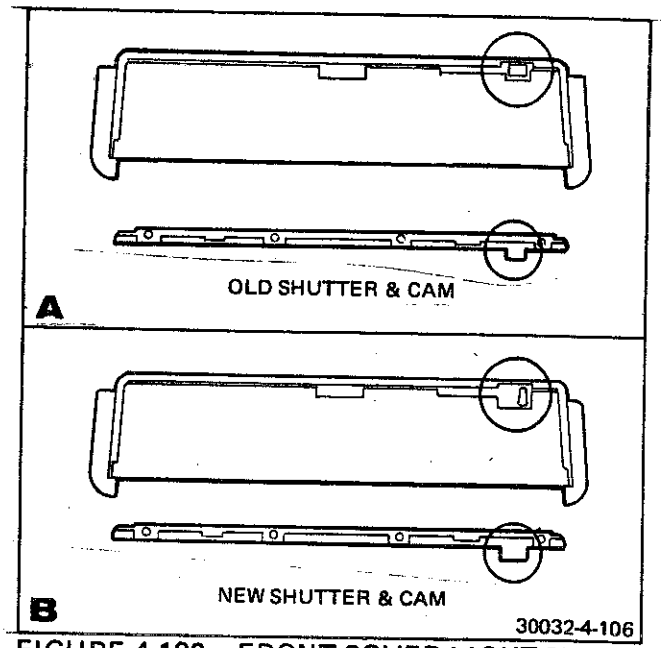


FIGURE 4-106 FRONT COVER LIGHT SHIELD CAM

Do this by simply exchanging the complete FRONT COVER, Figure 4-107, for a new type with the large cam. Be sure to save the old front covers to repair cameras with good shutters (old type) but damaged front covers.

The cam itself is also available. If no new type front covers are on hand, it is possible to remove the old cam and install the new type.

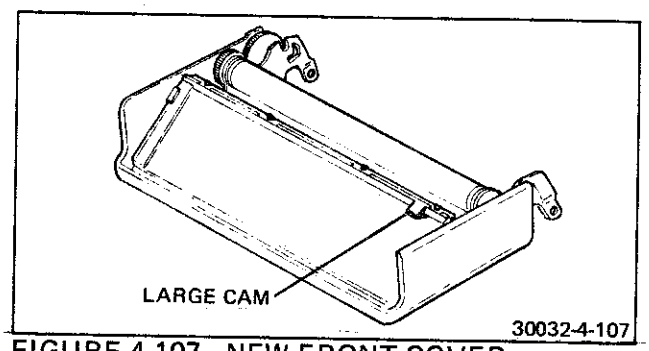


FIGURE 4-107 NEW FRONT COVER

The new cam should be installed in the same place and manner as the old cam. See Figure 4-108 for explanation. Remove the old cam by applying heat to the plastic rivets. Place the new cam in the same position, making sure the cam lip goes over the edge of the light-shield as shown, and the pins go through the four holes. When assembled, apply heat enough to peen over the ends of the pins projecting through the holes – thus staking the unit is place.

Part Numbers: New Front Cover 705439
New Cam 705386

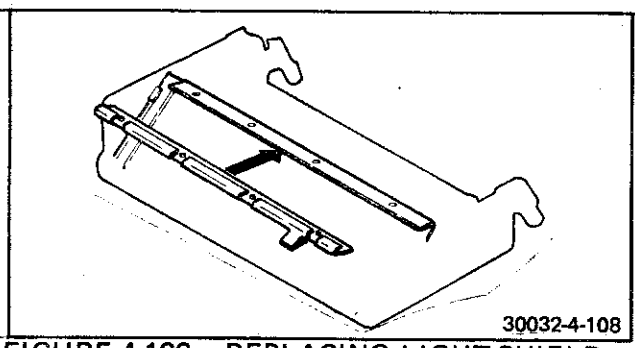


FIGURE 4-108 REPLACING LIGHT SHIELD CAM

14. Remove the two screws from the trim assembly.
15. Lift off the trim assembly.
16. Use Special Tool #11655. Remove the focus wheel retainer screw and the focus wheel pivot.
17. Remove the positive stop pin, cam follower spring, and cam follower assembly.
18. Using tweezers, reach down into the stop-pin cavity and remove the spring.
19. Remove the screw (or Truarc snap ring on some models) securing the trim link.
20. Lift off the trim link.
21. Use Truarc Pliers. Remove the idler gear retaining ring.
22. Remove the idler gear (see Figure 4-109).

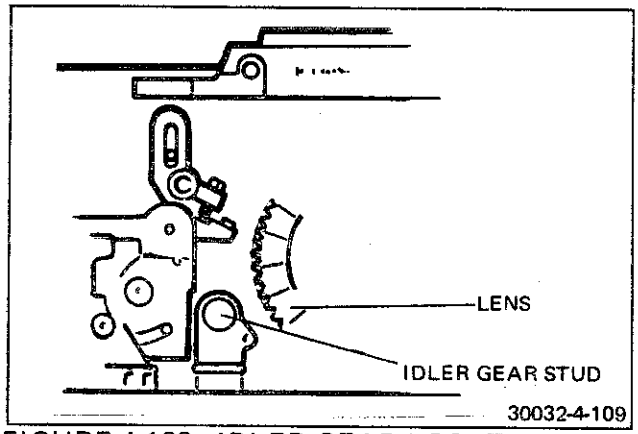


FIGURE 4-109 IDLER GEAR LOCATION

23. Use Special Tool #11539. Unscrew and remove trim link stand-off bushing.

24. Remove Solenoid no. 1 as follows:

NOTE: On models which use a snap ring on the trim link bushing, the bushing is not removeable. If the camera contains a ceramic substrate, the shutter assembly must be heated to approximately 150° F before proceeding.

a. Remove single screw holding the shutter to the hinge bracket.

b. Unsolder the four solenoid no. 1 connections at the back side of the substrate.

c. It may be necessary to remove surplus solder by means of solder-wick prior to releasing the connection.

d. Lift the flex circuit locating tab from the locating pin.

e. Insert the end of a dental pick (Tool #1695) under one of the flex circuit leads and lift the lead from its solder pad as heat is applied.

f. Repeat the procedure for each of the remaining leads.

g. Turn the shutter over (front side up).

h. The solenoid retaining screw is under the solenoid in the bottom edge of the shutter casting. Remove the solenoid retaining screw.

i. Use tweezers and set the walking beam at the approximate center of its stroke.

j. Hold the walking beam and lift out the solenoid together with the walking beam assembly as a unit. The tab on the flex circuit must be carefully guided through the slot in the casting.

NOTE: The solenoid connections are unsoldered at the back of the shutter because if the front connections are unsoldered the contacts could distort or drop into the shutter mechanism without being seen.

25. Remove S1 Remote Control Assembly (consisting of the insulator block and contacts).

a. At the back side of the shutter use solder-wick and remove all solder from the S1 and the Solenoid no. 2 contacts. Make sure that the contact tabs are completely free of the solder pads.

b. Use Special Tool #11661 (open-end wrench). Remove the solenoid retaining nut. As the nut is loosened, draw the solenoid away from the casting.

c. When the nut is completely free, remove the solenoid.

d. Turn the shutter over and remove the S1 retaining screw. Remove S1.

26. Remove the Pillar (flash) socket.

a. At the back side of the shutter use solder-wick and clean the six socket contacts. Make sure that the contact tabs are straightened and are free from the solder pads. Be careful to prevent lifting the solder pads from the substrate.

b. Start with the group of four socket connections. Use a dental pick to raise each connector as heat is applied. Straighten the tabs to vertical.

c. When all six tabs have been unsoldered the substrate will still be captured by the cable clamp screw. Remove the screw from the cable clamp and remove the substrate from the casting.

d. Use Special Tool #11710. Press out the two rivets securing the pillar socket to the casting. Remove the socket. See Figure 4-110.

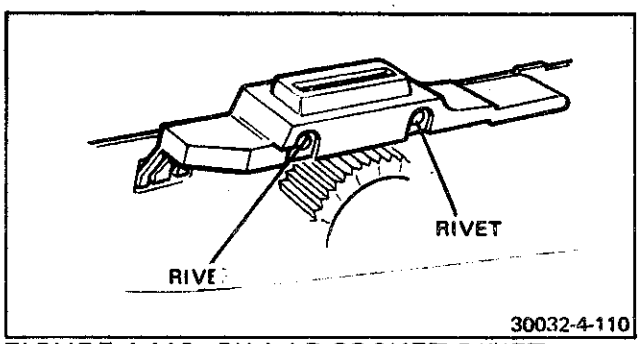


FIGURE 4-110 PILLAR SOCKET RIVET LOCATIONS

27. Remove the Idler-Gear Stud.
    a. Use tweezers and remove the square-shaped spring located at the base of the stud. See Figure 4-111.
    b. On the bottom edge of the shutter casting remove the stud set screw.
    c. Remove the stud from the casting.
28. Remove the Photocell Lens.
    a. Grasp the lens and pull forward until the heat-seal tabs are snapped.
    b. Clean any loose plastic particles from the locating holes.
29. Remove the Shutter Blades/Lens Assembly.
    a. Remove the four lens retaining screws at the rear of the casting.
    b. Using tweezers align the two shutter-blade pins with the walking-beam stud.
    c. Remove the lens and blades as a single assembly. It will be necessary to tip the blades and slide them up from behind the photocell lens.

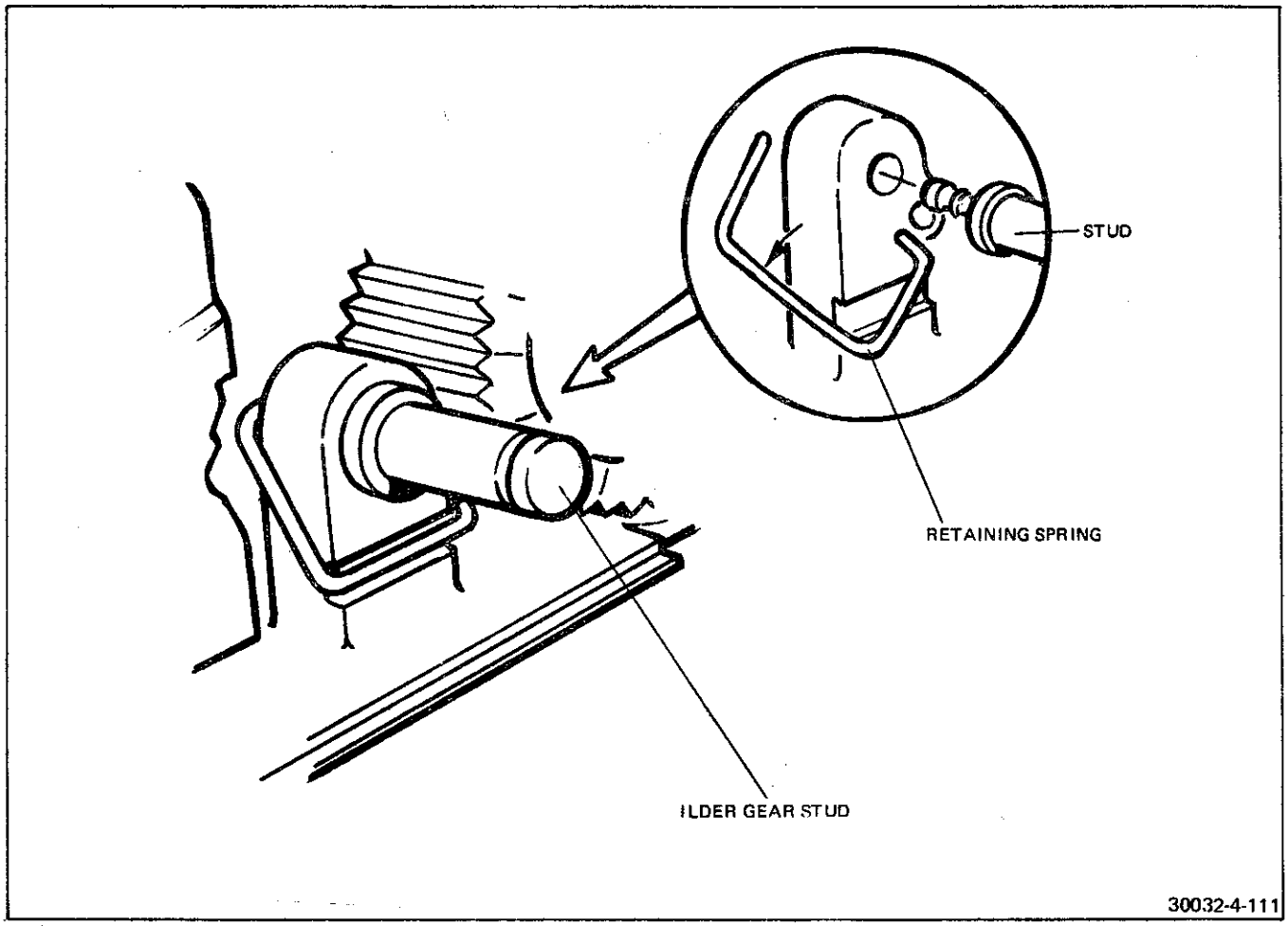


FIGURE 4-111 IDLER GEAR STUD REMOVAL

AF. SHUTTER COMPONENTS, INSTALL

1. Install Pillar (flash) Socket.
   a. Position the socket on the casting.
   b. Procure the special flat-head screws and nuts (part no. 11711) or rivets and Special Tool #11735.
   c. Insert the screws through the assembly from the back side of the casting.
   d. Apply a drop of Loctite to the threads of each screw.
   e. Install and tighten the two nuts.
2. Install Shutter Blade/Lens Assembly.
   a. Adjust the shutter blades to a partially open position.
   b. Position the assembly in the casting.

      NOTE: In the following step, do not tighten any one screw. Proceed around the lens and tighten all four screws evenly to avoid tilting the lens mount in the casting.

   c. Install the four screws through the back side of the shutter casting.
3. Install the Photocell Lens.
   a. Position the lens and press the two heat-seal studs into the holes in the casting.
   b. Turn the shutter over and apply the heat-sealing tool to seal the studs.
4. Install the S1 Remote Control Assembly
   a. Position the assembly in the casting.
   b. Install and tighten the single mounting screw.
5. Install Solenoid no. 2.
   a. There are two insulated connecting tabs and a short locating stud in addition to the threaded mounting stud. Place the solenoid in position carefully so that the locating stud bottoms in its locating hole.
   b. Use tool no. 11661. Install and tighten the mounting nut.
6. Install Idler Gear Assembly.
   a. Install the idler-gear post in its socket in the casting.
   b. In the bottom edge of the casting install and tighten the post set screw. Use size DS-033-4 Bristol screwdriver.
   c. Using tweezers, install the square-shaped idler-gear spring.
7. Install Solenoid no. 1/Walking Beam.
   a. Feed the flex-circuit tab through the slot in the casting.
   b. Using tweezers, align the shutter-blade pins with the walking-beam mounting post.
   c. Position the walking beam on the top of the post. While slowly-moving the assembly down the post, use tweezers to align the shutter pins with the slots in the walking beam so that, when the assembly reaches the bottom of the post, the pins will be seated in the slots.
   d. Using tweezers actuate the walking beam to insure that both shutter blades move.
   e. In the bottom edge of the shutter casting install the single screw to secure solenoid no. 1.
8. Install the Substrate

   NOTE: If a replacement substrate is to be installed, disconnect the ribbon cable at the camera flex circuit.

   a. Position the substrate in place on the back side of the shutter casting.
   b. Align all locating pins and contact tabs and carefully press the substrate into place.
   c. The solder tabs for the pillar socket (flash socket) are in two groups, one with four tabs and one with two tabs. If any part of the solder pads for the two-tab group was lifted from the substrate during disassembly, the tabs may be bent in the opposite direction to meet an undamaged section of the pads. It will be necessary, however, to cut the tabs to such a length that they will not short circuit other areas of the substrate when they are bent down and soldered.
   d. Bend down the four tabs at the other end of the pillar socket.
   e. Switch S1 and the solenoid no. 2 contacts should touch one side of the solder pad to insure good connections.
   f. Apply the special flux to all connections to be soldered in the following steps.
   g. Use tweezers and pull the flex-circuit tab from solenoid no. 1 over the substrate and press the circuit locating hole over the locating pin.
   h. Using the special soldering iron, solder all fourteen connections.
   i. Procure special gage no. 11709. Place the gage over the soldered joints and check that

sufficient clearance exists so that the bottom surface of the gage will contact the substrate at all points. If any soldered contact touches the gage, use solder-wick and remove the excess solder. Recheck with the gage.

j. Install the cable clamp and install and tighten the screw. See Figure 4-112.

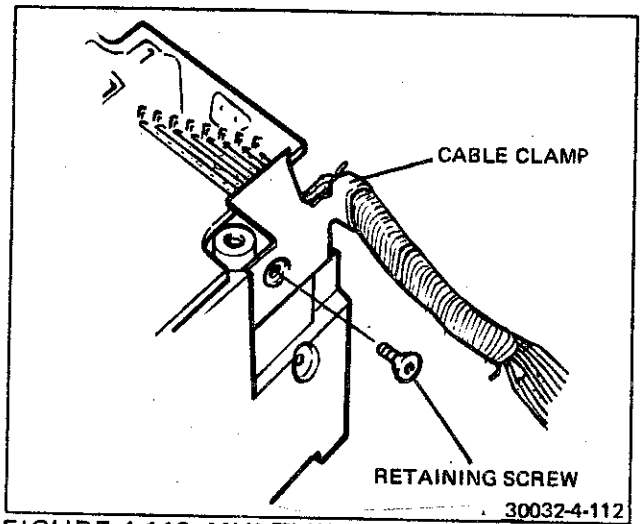


FIGURE 4-112 MULTI-WIRE CABLE CLAMP

9. Install Shutter Assembly on Hinge Bracket.
   a. Position the shutter on the bracket.
   b. Install one of the four retaining screws.
10. Install Cam Follower Assembly.
   a. The cam follower assembly includes the interceptor which must reach under the pull-down bar of solenoid no. 2. Use tweezers and slide the interceptor under the bar. At the same time position the cam follower so that its slot is centered over the threaded hole in the mounting post (see Figure 4-113).
   b. Install the focus wheel pivot into the threaded hole and tighten the pivot with Special Tool #11655.
11. Install the Trim Link.
   a. Using a miniature nut driver install and tighten the trim-link standoff.
   b. Place the trim link over the stand-off and engage the pin with the slot in the cam follower.
   c. Install and tighten the retaining screw in the stand-off.
12. Install Positive Stop Pin.
   a. Install the compression spring into the positive-stop-spring socket in the shutter casting.

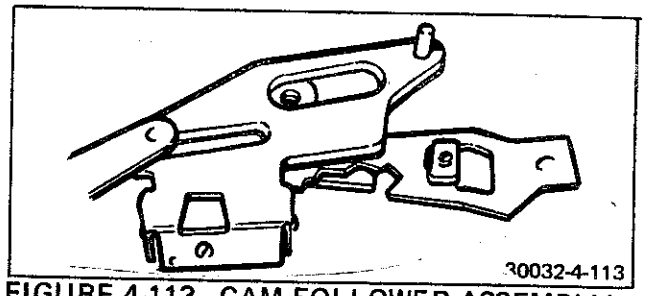


FIGURE 4-113 CAM FOLLOWER ASSEMBLY

   b. Insert the stop pin on top of the compression spring.
   c. Identify the cam-follower-to-positive-stop-pin spring.
   d. Hook one end of the spring into the hole adjacent to the adjusting screw in the top of the cam follower assembly.
   e. Hook the other end of the spring onto the positive stop pin.

13. Solenoid 2 Failures and Adjustments.

Configuration A thru M shutters occasionally fail in flash mode. The problem is interceptor hang-up. When focused at 8 feet or less, the interceptor can stick on the mounting base, near the walking beam pivot. To eliminate this problem, follow these directions:

1. Remove shutter but do not unsolder.
2. Remove shutter front housing.
3. Remove focus wheel.
4. Adjust Sol 2 adjusting screw in this manner:
   a. Use a jeweler's screwdriver on top of the solenoid #2 plunger and press down as far as possible, firmly seating the plunger.
   b. Check solenoid #2 stroke as follows: Close shutter blades by pushing solenoid #1 plunger with a tweezer or probe. While solenoid #1 is pulled in, push in the solenoid #2 plunger as directed above. (Do not push down the pull down bar.) Check position of the interceptor pin on the walking beam as solenoid #1 is let out. The interceptor should contact the pin approximately in the middle of the narrow section. If solenoid #2 requires adjustment, do so with the adjusting nut. If nut is glued, do not attempt to break it loose but correct the solenoid 2 stroke by bending the pull down bar at the point of the bend across the hole in the bar. Once properly set, disengage the interceptor by pushing in solenoid #1.
   c. While holding the solenoid #2 plunger seated,

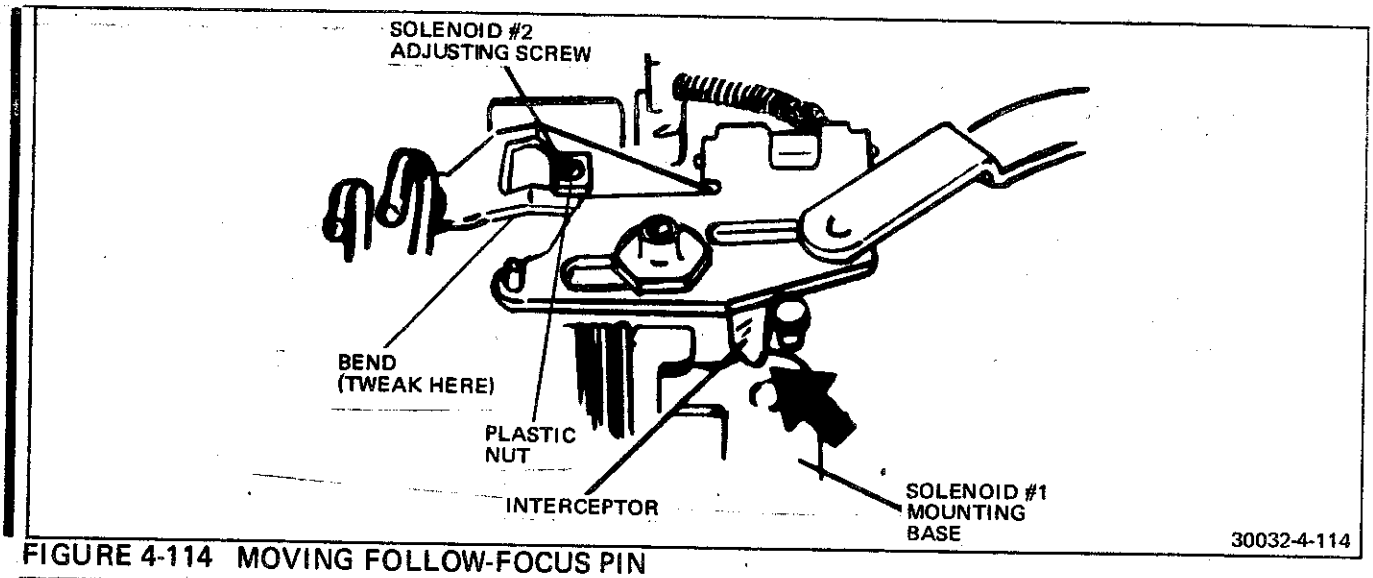


FIGURE 4-114 MOVING FOLLOW-FOCUS PIN

use tweezers to move the follow focus pin toward the lens and allow it to snap back. See Figure 4-114. The interceptor should meet the pin as previously described and must not touch the mounting bracket.

d. If the interceptor does not meet this criterion, adjust the screw in the center of the nut, or tweak as explained to bring it into position.

NOTE: Turning the screw allows the black plastic nut to move along the screw threads thus changing the thrust of the pull down bar.

e. After completing the process, apply a very small amount of Loctite, 404 or 04E to the screw.

14. Install the Focus Wheel.

a. Rotate the lens mount clockwise to its stop, then rotate counterclockwise approximately three gear teeth.

b. Examine the bottom side of the focus wheel. Note that it has a spiral groove and two rectangular depressions. See Figure 4-115. One is positioned close to the spiral groove. The positive stop pin must engage the other rectangular depression (the one farthest from the spiral groove.) The pin on the cam follower must engage the spiral groove. Install the wheel so that the foregoing conditions are met.

c. Install the hex-head focus wheel retaining screw. Use Special Tool #11655. Tighten the hex-head screw.

d. Rotate the focus wheel through its travel to insure proper location of the stop pin.

e. Install the idler gear on its post. If the idler gear was previously adjusted it will be necessary to see that the gear teeth are all engaged. If the idler gear is new, the foregoing may not be required because the gears may not have not been adjusted to mesh.

NOTE: Whenever to idler gear and/or focus wheel is replaced, the lens must be collimated. See Collimation, Section III.

15. Install Trim Assembly.

a. Set the trim wheel at the normal position.

b. Set the assembly on the casting so that the two locating studs enter the locating holes in the casting.

c. Check to see that the plastic stud on the trim wheel mates with the slot in the trim link.

d. Install and tighten the two retaining screws.

e. Check the operation of the trim wheel.

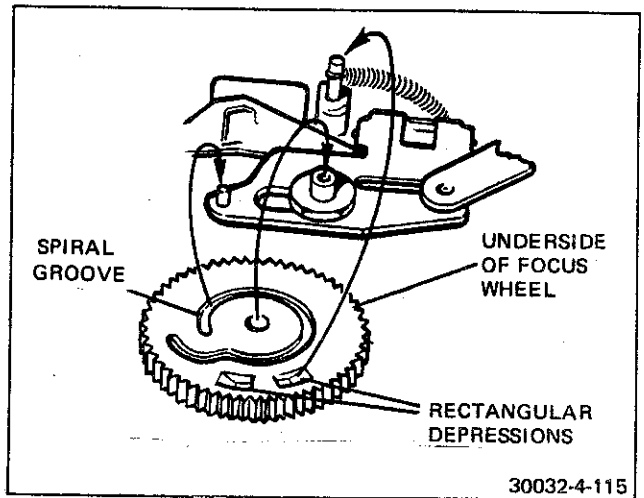


FIGURE 4-115 FOCUS WHEEL CONFIGURATION

16. Cam Follower Adjustment.

The cam follower is adjusted during the performance of test-set checks of the camera.

a. The adjustment requires that power be applied to the shutter. Install the special shutter housing containing the hole for cam-follower adjustment.

b. Perform the electrical test as described in Section III.

c. Using a narrow-blade jeweler's screwdriver through the adjusting hole, rotate the cam-follower adjusting screw as necessary to produce the proper meter reading.

17. Shutter Housing Components, Remove.

a. Remove the lens bezel by pressing the edge of the bezel from inside the housing.

b. Insert a fingernail under the edge of the photocell bezel and snap out the bezel.

c. Melt the heat seal and press out the S1 insulator from inside of the housing.

18. Shutter Housing Components, Install.

a. Install the lens bezel.

(1) The bezel has a large rectangular cutout in its rim. When installing the bezel, the cutout should be approximately 8 o'clock when viewed from the front of the housing.

(2) At 6 o'clock the bezel has a tiny locking tab. Locate this tab to align with the notch on the inside edge of the housing.

(3) Press the bezel into place.

b. Install the photocell bezel.

(1) Align the three tabs with the three cutouts in the housing.

(2) Press the bezel into place.

c. Install the S-1 insulator.

(1) Press the insulator into place from the outside of the housing.

(2) Use a heat-sealing tool and seal the insulator in place.

d. Install the housing on the shutter.

(1) Remove the single screw holding the shutter to the shutter hinge bracket.

(2) Rotate the lens to its clockwise stop.

(3) Place the housing in position on the shutter so that the focus and trim wheel protrude through the correct slots.

(4) Snap the bottom of the housing over the casting.

(5) Install and tighten the two shutter-to-housing screws.

(6) Check to see that the four light seals are properly in place on the hinge bracket.

(7) Position the shutter on the hinge bracket and align the locating pins.

(8) Install and tighten the four retaining screws.

The following paragraphs describe individual replacement procedures for discrete components. In these procedures the minimum number of components are removed to accomplish the desired replacement.

AG. LENS AND SHUTTER BLADES, REMOVE

1. Remove the front cover.
2. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter to the bracket. See Figure 4-116. Lift off the shutter.
3. Remove the two retaining screws from the upper corners at the back side of the shutter.
4. Rotate the lens to its clockwise stop.
5. Pry each side of the housing away from the casting.
6. Remove the shutter housing from the casting.
7. Place the shutter casting on the hinge bracket and install one of the four retaining screws.
8. Use Special Tool #11655. Remove the focus wheel retainer screw and the focus wheel pivot.
9. Remove the positive stop pin, cam follower spring, and cam-follower assembly.
10. Using tweezers, reach down into the stop-pin cavity and remove the spring.
11. Remove the screw securing the trim link. (Some shutters use a snap ring instead of a screw.)
12. Lift off the trim link.
13. Remove the two screws from the trim assembly.
14. Lift off the assembly.
15. Use Truarc pliers. Remove the idler gear retaining ring.
16. Remove the idler gear.
17. Use Special Tool #11539. Unscrew and remove the trim link stand-off bushing.

Gears in the front cover must engage the main gear train of the camera before the gear train is put into motion. A switch (S7) located in the forward section of the gear train compartment initiates the application of power to the gear train drive motor. Switch S7 is actuated by two components.

(1) A cam on the right rear edge of the front cover (Figure 1-6A), and,

(2) A projection on the front cover latch (Figure 1-6B).

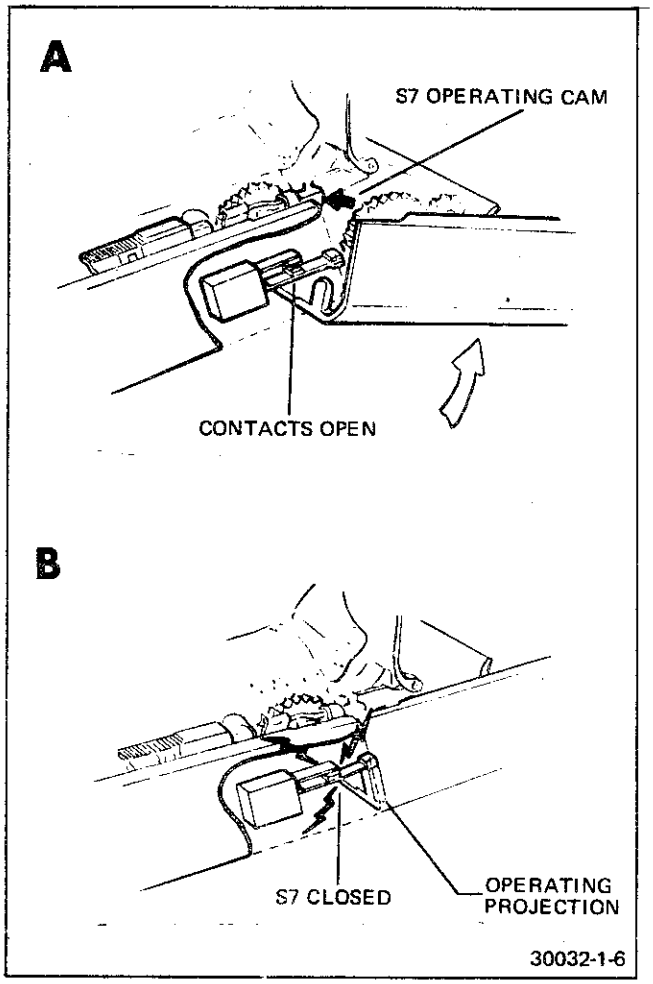


FIGURE 1-6 S7 CONTACTS OPEN AND CLOSED

Thus, the cover must be fully closed and the gears engaged, and the latch fully seated, in order to actuate the drive motor.

When S7 initiates power to the drive motor (S8 is also involved and is discussed in a following paragraph), the gear train is set in motion and actuates a device called the film pick. The pick engages the dark slide, pushes it in to the spread rolls and the dark slide is ejected from the lower front edge of the front cover. The gears mentioned in the previous paragraph drive the spread rollers.

4. Setting the Exposure Counter

When a used film pack is removed from the film chamber, the action mechanically sets the exposure counter at the rear of the camera to the start position, closing S8. When the front cover is closed and latched (closing S7) and a film pack is installed, (Figure 1-7), the motor is actuated and the dark slide is ejected. The exposure counter turns to number 10.

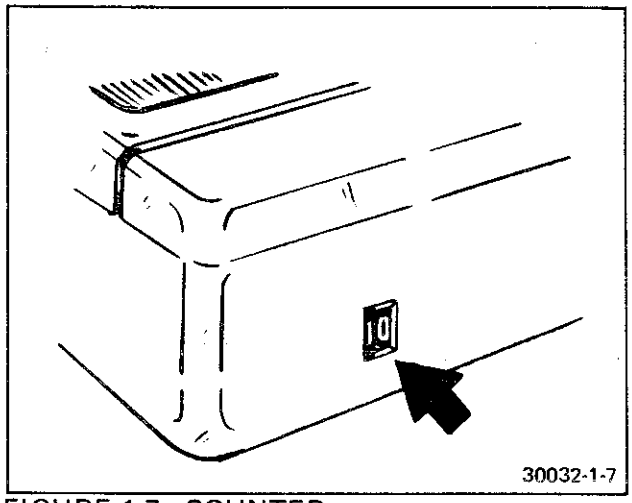


FIGURE 1-7 COUNTER

5. Viewing and Focusing

Viewing and focusing is accomplished by a reflex system. The image passes through the lens to a fixed mirror where it is reflected down to a Fresnel viewing screen. The viewfinder assembly contains an eyepiece lens and a parabolic mirror to direct and focus the eye on the surface of the Fresnel screen. The camera lens is focused by a rotating knurled wheel and is adjusted so that the image on the Fresnel screen appears sharp at the eyepiece (Figure 1-8A).

6. Making the Exposure

The exposure is made by pressing the release button. This completes the electrical circuit to the shutter to initiate a series of events. The shutter closes to cut off the optical path. The hinged Fresnel viewing screen is swung upward and comes to rest in front of the fixed viewing mirror (Figure 1-8B).

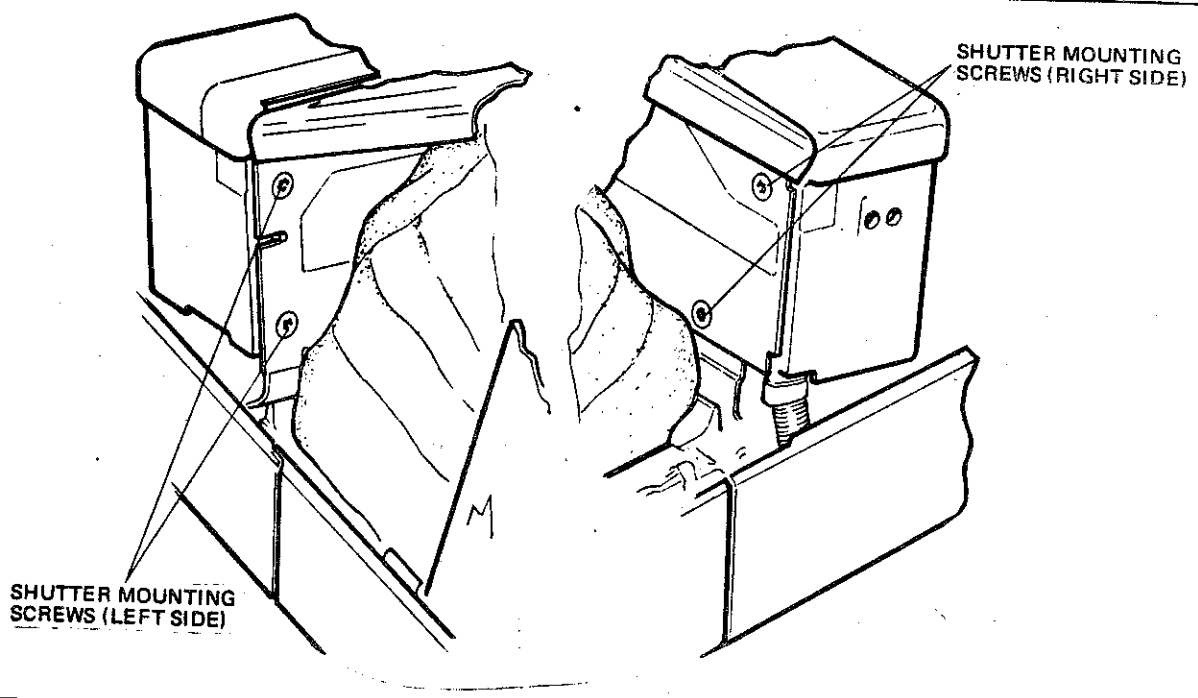


FIGURE 4-116 SHUTTER MOUNTING SCREWS

30032-4-116

18. Remove Solenoid no. 1.

    a. Remove the single screw holding the shutter to the hinge bracket.

    Caution: If a ceramic substrate is used, heat to 150° F before unsoldering.

    b. Unsolder the four solenoid no. 1 connections at the back side of the substrate.

    c. It may be necessary to remove surplus solder by means of solder-wick prior to releasing the connection.

    d. Lift the flex circuit locating tab from the locating pin.

    e. Insert the end of a dental pick (Tool # 1695) under one of the flex-circuit leads and lift the lead from its solder pad as heat is applied.

    f. Repeat the procedure for each of the remaining leads.

    g. Turn the shutter over (right side up).

    h. The solenoid retaining screw is under the solenoid in the bottom edge of the casting. Remove the solenoid retaining screw.

    i. Use tweezers and set the walking beam at the approximate center of its stroke.

    j. Hold the walking beam and lift out the solenoid together with the walking beam as a unit. The tab on the flex circuit must be carefully guided through the slot in the casting.

    NOTE: The solenoid connections are unsoldered at the back of the shutter because if the front connections are unsoldered the contacts could distort or drop into the shutter mechanism without being seen.

19. Turn the shutter over and remove the four lens retaining screws.

20. Remove the lens/shutter blade assembly.

AH. LENS AND SHUTTER BLADES, INSTALL

1. Before installing, examine the lens and blades. If cleaning is required, use special lens cleaning fluid and lens tissue for the lens. To clean the blades use liquid Freon and a cotton swab.

2. Position the lens/shutter blade assembly in the casting.

    NOTE: In the following step, do not tighten any one screw. Proceed around the lens and tighten all four screws evenly to avoid tilting the lens mount in the casting.

3. Install the four screws through the back side of the shutter casting.

4. Install Solenoid no. 1.

   a. Feed the flex-circuit tab through the slot in the casting.

   b. Using tweezers, align the shutter-blade pins with the walking-beam mounting post.

   c. Position the walking beam on the top of the post. While slowly moving the assembly down the post, use tweezers to align the shutter pins with the slots in the walking beam so that when the assembly reaches the bottom of the post, the pins will be seated in the slots.

   d. Using tweezers actuate the walking beam to insure that both shutter blades move.

   e. In the bottom edge of the shutter casting, install the single screw to secure solenoid no. 1.

5. Install the substrate.

   NOTE: If a replacement substrate is to be installed, disconnect the ribbon cable at the camera flex circuit.

   a. Position the substrate in place on the back side of the shutter casting.

   b. Align locating pins and contact tabs and carefully press the substrate into place. See Figure 4-117.

   c. The solder tabs for the pillar socket (flash socket) are in two groups, one with four tabs and one with two tabs. If any part of the solder pads for the two-tab group was lifted from the substrate during disassembly, the tabs can be bent in the opposite direction to meet an undamaged section of the pads. It will be necessary, however, to cut the tabs to such a length that they will not short circuit other areas of the substrate when they are bent down and soldered.

   d. Bend down the four tabs at the other end of the pillar socket.

   e. Switch S1 and the Solenoid no. 2 contacts should touch one side of the solder pad to insure good connections.

   f. Apply the special solder flux to all connections to be soldered in the following steps.

   g. Use tweezers, and pull the flex-circuit tab from solenoid no. 1 over the substrate and press the circuit locating hole over the locating pin.

   h. Using the special soldering iron, solder all fourteen connections.

   i. Check height to prevent shorting on shutter mounting bracket.

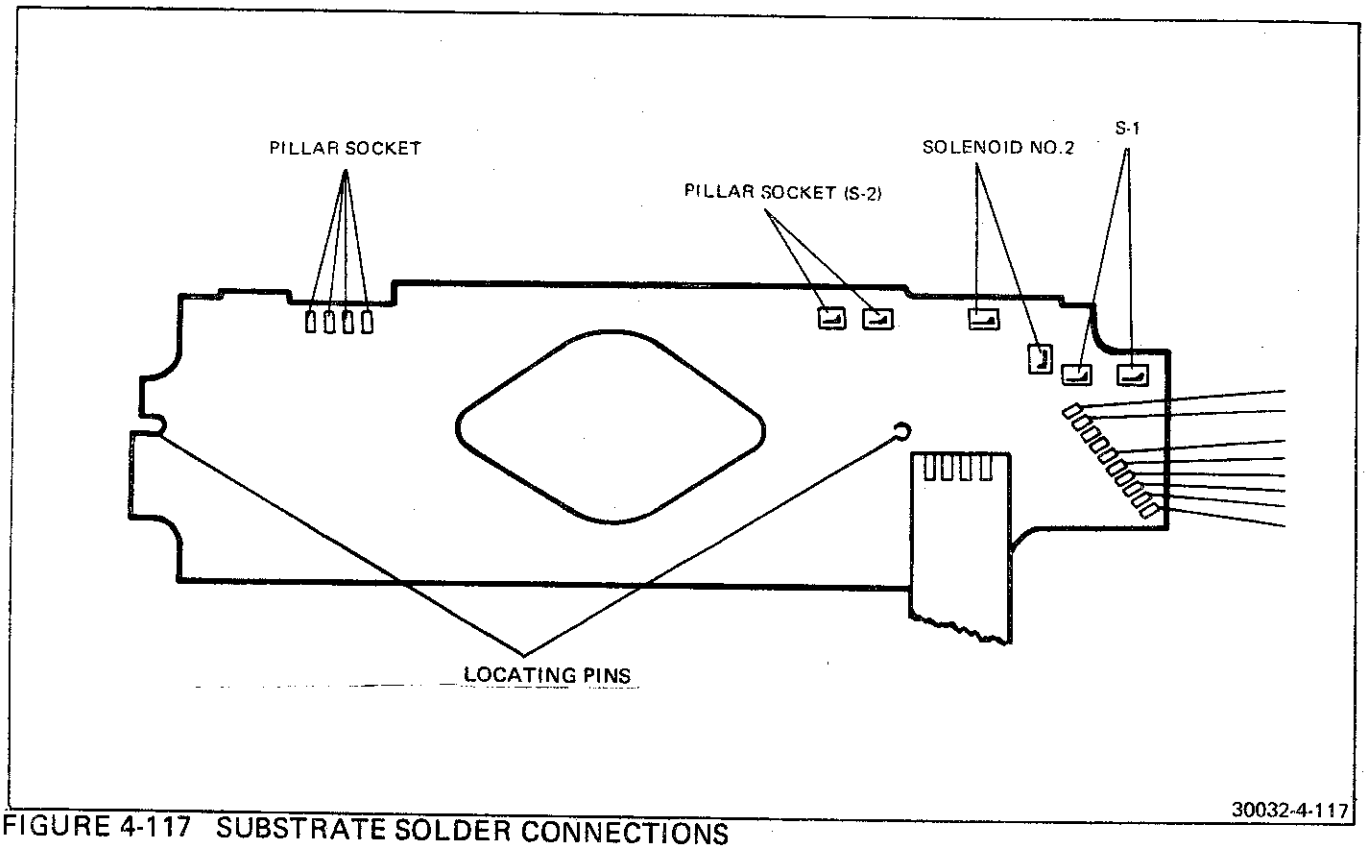


FIGURE 4-117 SUBSTRATE SOLDER CONNECTIONS

j. Install the cable clamp and install and tighten the screw. See Figure 4-118.

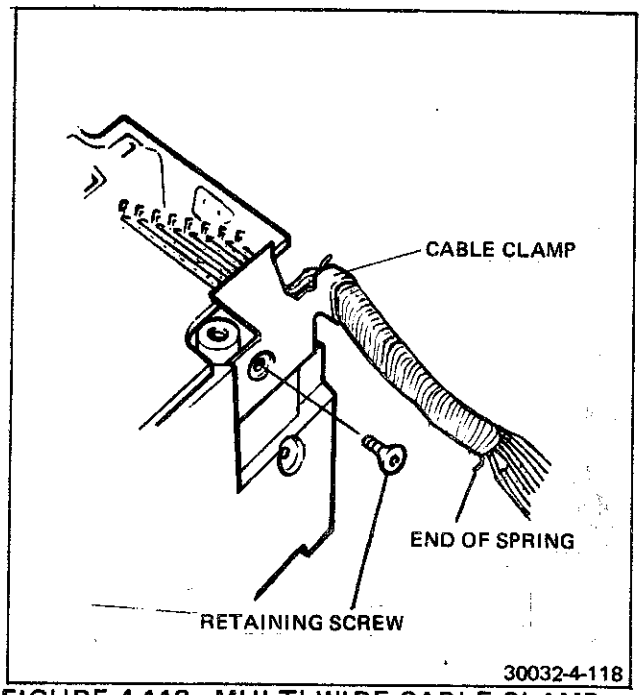


FIGURE 4-118 MULTI-WIRE CABLE CLAMP

6. Position the shutter on the hinge bracket and install one of the four retaining screws to hold the shutter while performing the following steps.
7. Install the Cam Follower Assembly.
   a. The cam follower assembly includes the interceptor which must reach under the pull-down bar of the solenoid no. 2. Use tweezers and slide the interceptor under the bar. At the same time, position the cam follower so that its slot is centered over the threaded hole in the mounting post.
   b. Install the focus wheel pivot into the threaded hole and tighten the pivot with Special Tool #11655.
8. Install the Trim Link.
   a. Using a miniature nut driver install and tighten the trim-link standoff.
   b. Place the trim link over the standoff and engage the pin with the slot in the cam follower.
   c. Install and tighten the retaining screw in the standoff.
9. Install the Positive Stop Pin.
   a. Install the compression spring into the positive-stop-spring socket in the shutter casting.
   b. Insert the stop pin on top of the compression spring.
   c. Identify the cam-follower-to-positive-stop-pin spring.
   d. Hook one end of the spring into the hole adjacent to the adjusting screw in the top of the cam-follower assembly.
   e. Hook the other end of the spring onto the positive stop pin.
10. Install the Focus Wheel.
   a. Rotate the lens mount clockwise to its stop (infinity).
   b. Examine the bottom side of the focus wheel. Note that it has a spiral groove and two rectangular depressions. One is positioned close to the spiral groove. The positive stop pin must engage the other rectangular depression (the one farthest from the spiral groove). The pin on the cam follower must engage the spiral groove. Install the wheel so that the foregoing conditions are met.
   c. Install the hex-head focus wheel retaining screw. Use Special Tool #11655. Tighten the hex-head screw.
   d. Install the idler gear on its post. If the idler gear was previously adjusted it will be necessary to see that the gear teeth are all engaged. If the idler gear is new, the foregoing may not be required because the gears have not been adjusted to mesh.

   NOTE: Whenever the idler gear and/or focus wheel is replaced, the lens must be collimated. See Section III.
11. Install the Trim Assembly.

   NOTE: Prior to installing the trim assembly, check to determine that the friction spring will hold the adjusting wheel at either end of its range with no slippage. If necessary, use needle-nose pliers to bend the spring to increase tension.
   a. Set the trim wheel at the normal position.
   b. Set the assembly on the casting so that the two locating studs enter the locating holes in the casting.
   c. Check to see that the plastic stud on the trim wheel mates with the slot in the trim link.
   d. Install and tighten the two retaining screws.
   e. Check the operation of the trim wheel.
12. Install the Housing on the Shutter.

a. Remove the single screw holding the shutter to the shutter hinge bracket.

b. Rotate the lens to its clockwise stop.

c. Place the housing in position on the shutter so that the focus and trim wheels protrude through the correct slots.

d. Snap the bottom of the housing over the casting.

e. Install and tighten the two shutter-to-housing screws.

f. Check to see that the four light seals are properly in place on the hinge bracket.

g. Position the shutter on the hinge bracket and align the locating pins.

h. Install and tighten the four retaining screws.

AI. SUBSTRATE, REMOVE

1. Remove the front cover and the bottom cover from the camera.
2. Unsolder the ribbon cable at the flex circuit.

   a. Starting with lead no. 1 of the cable, insert the point of a sharp blade (a pointed blade Xacto knife is recommended) under the wire. The sharpened edge of the blade must be held so that it makes physical contact at the junction point of the wire lead and the solder pad of the flex circuit. **Do not** insert the point of the blade beyond lead no. 1. See Figure 4-119.

   b. By exerting a slight clockwise twist to the blade, apply upward pressure to the end of the lead.

   c. While maintaining a steady upward pressure with the knife blade, bring the tip of the soldering iron into contact with the copper pad on the side of the soldered connection opposite the cable lead.

   d. At the instant that the knife blade breaks the soldered joint, remove the soldering iron. Hold the knife blade steady for a moment to allow the pad and the wire to cool.

   e. Repeat the foregoing procedure for each of the cable leads.

   Caution: Under no circumstances attempt to heat and remove more than one lead at a time.

   f. Peel off the decal which covers the cable clamps.

3. Carefully spread the cable clamp just enough to permit removal of the cable retaining spring and slip the spring out of the clamp.
4. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter casting to the bracket. Lift off the shutter.

   Caution: If the camera is equipped with a ceramic substrate, heat the shutter to 150° F before unsoldering.

5. At the back side of the substrate unsolder the fourteen connections and remove any excess solder with solder-wick.
6. On the bottom edge of the shutter, remove the cable-clamp retaining screw.
7. Remove the substrate from the casting.

AJ. SUBSTRATE, INSTALL

1. Position the substrate on the casting and press into place to engage the locating pins.
2. Install the cable clamp on the ribbon cable.
3. Install and tighten the clamp screw.
4. On the back side of the substrate, solder all fourteen connections (see CAUTION). The connecting tabs must contact one side of the solder pad before solder is applied. Bend the S2, solenoid no. 2, and the pillar socket tabs flat against the substrate.
5. Check height to prevent shorting to shutter bracket.
6. Install the shutter on the hinge bracket and install the four mounting screws.
7. Connect the ribbon cable to the flex circuit.
8. Examine the flex circuit solder pads. If the solder is not deposited smoothly, reheat and smooth the solder pads.
9. Apply a small quantity of Alpha no. 611 solder flux to the flex circuit pads and the ends of the ribbon cable.
10. Orient the cable and dress the end of each lead so that it seats squarely in the center of its solder pad, and hold the cable firmly in this position.
11. Refer to Figure 4-119. Place the blade of a jeweler's screwdriver on top of the bare end of the number 1 lead exactly at the point where the insulation begins. Press down firmly to create a positive heat sink.
12. Apply the tip of the soldering iron so that it makes simultaneous contact with the pad and the trimmed end of the wire lead.

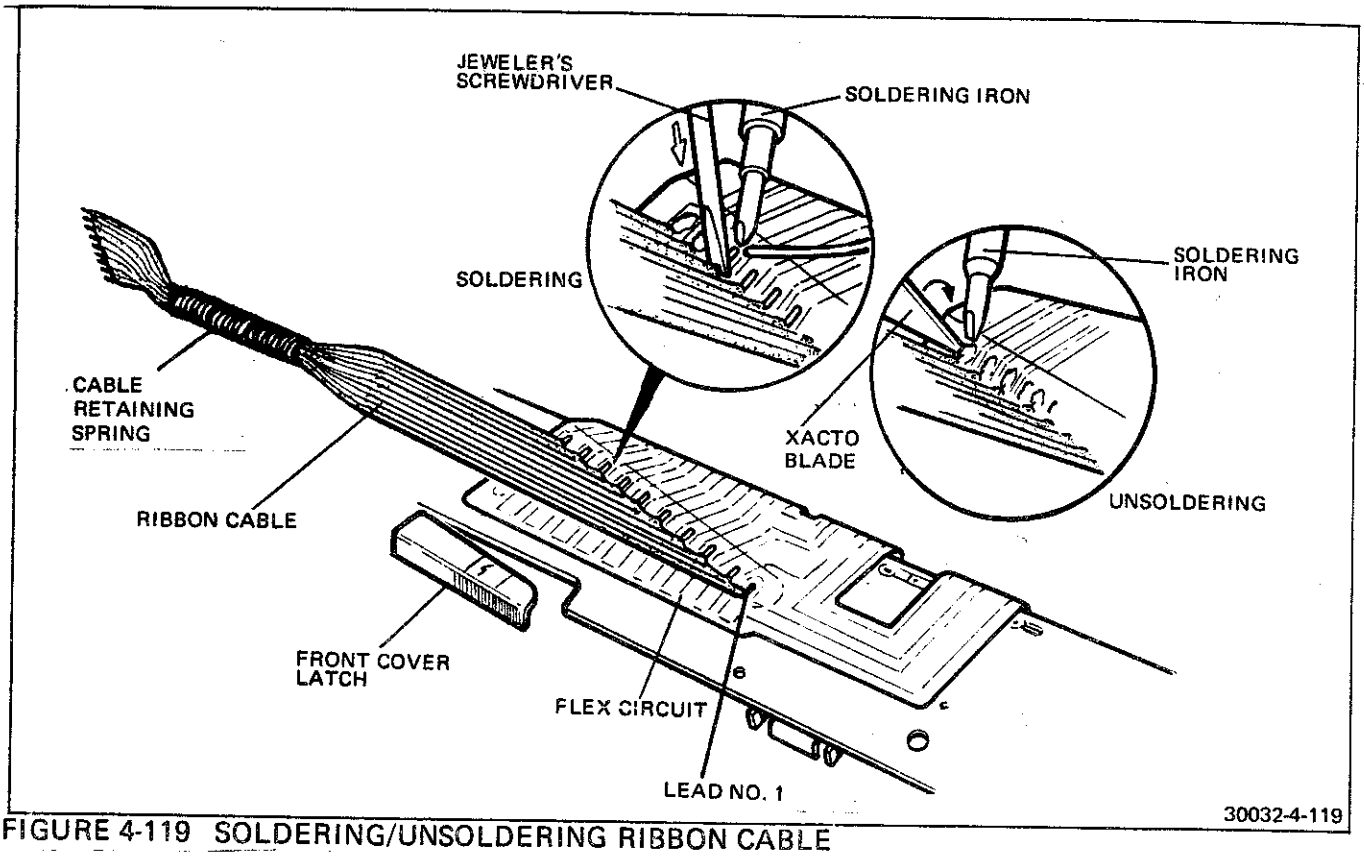


FIGURE 4-119 SOLDERING/UNSOLDERING RIBBON CABLE

13. Hold the iron in place just until the solder on the wire and the pad flow into a smooth joint.
14. Do not remove the screwdriver blade until the solder has cooled (one or two seconds).
15. Apply a small amount of Alpha no. 1001 Reliasolve solvent to clean the soldered joints, and wipe dry with a Q-tip.
16. Install the bottom cover and the front cover.

AK. PILLAR SOCKET, REMOVE

1. Remove the front cover and the bottom cover.
2. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter casting to the bracket.
3. At the rear of the casting, remove the shutter housing retaining screws.
4. Remove the shutter housing.
5. Remove the two screws from the trim assembly.
6. Remove the trim-link screw and swing the trim link out of the way.

Caution: If the shutter contains a ceramic substrate, heat the shutter to 150° F before unsoldering.

7. At the back side of the substrate, unsolder the six pillar-socket connections.
8. Turn the shutter over and remove the two rivets. Use Special Tool #11710 to press out the rivets.
9. Lift out the pillar socket.

AL. PILLAR SOCKET, INSTALL

1. Set the pillar socket into place on the shutter casting.
2. Use Special Tool Riveter #11735 and insert rivets.
3. Swing the trim link into position.
4. Install and tighten the trim-link screw. (Install snap ring if camera is so equipped.)
5. Set the trim assembly into position on the casting.
6. Install and tighten the two screws.
7. On the back side of the substrate, solder the six pillar-socket connections. (Heat ceramic substrate.)

8. Install the shutter housing on the shutter casting and secure with the two screws.
9. Position the shutter on the hinge bracket and secure with the four screws through the back side of the bracket.
10. Replace the bottom cover and the front cover.

AM. SOLENOID NO. 1, REMOVE

1. Remove the front cover and the bottom cover from the camera.
2. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter casting to the bracket. Lift off the shutter.
3. Remove the two retaining screws from the upper corners at the rear of the shutter.
4. Rotate the lens clockwise to its stop.
5. Pry each side of the housing away from the casting and remove the shutter housing from the casting.
6. Set the shutter in place on the hinge bracket.
7. Place the shutter casting on the hinge bracket and install one of the four retaining screws.
8. Remove the two screws from the trim assembly and lift off the trim assembly.
9. Use Special Tool #11655. Remove the focus wheel retainer screw and the focus wheel pivot.
10. Remove the positive stop pin, cam follower spring, and cam follower assembly.
11. Using tweezers, reach down into the stop-pin cavity and remove the spring.
12. Remove the screw (or Truarc snap ring on some models) securing the trim link and lift off the trim link.
13. Remove the focus wheel stud.
14. Use Truarc pliers. Remove the idler gear retaining ring.
15. Remove the idler gear.

    Caution: If the camera is equipped with a ceramic substrate, heat the shutter to 150° F before unsoldering.

16. Turn the shutter over and unsolder the four flex circuit tab contacts. It may be necessary to remove surplus solder by means of solder-wick prior to releasing the connections.
17. Lift the flex circuit locating tab from the locating pin.
18. Insert the end of utility pick (Tool #11695) under one of the flex circuit leads and lift the lead from its solder pad as heat is applied.
19. Repeat the procedure for each of the remaining leads.
20. Turn the shutter over (front side up).
21. The solenoid retaining screw is under the solenoid in the bottom edge of the shutter casting. Remove the solenoid retaining screw.
22. Using tweezers, set the walking beam at the approximate center of its stroke.
23. Hold the walking beam and lift out the solenoid together with the walking beam assembly as a unit. The tab on the flex circuit must be carefully guided through the slot in the casting.

    NOTE: The solenoid connections are unsoldered at the back of the shutter because, if the front connections are unsoldered the contacts could distort or drop into the shutter mechanism without being seen.

AN. SOLENOID NO. 1, INSTALL

1. Thread the flex-circuit tab through the slot in the casting.
2. Using tweezers align the shutter-blade pins with the walking beam mounting post.
3. Position the walking beam on the top of the post. While slowly moving the assembly down the post, use tweezers to align the shutter pins with the slots in the walking beam so that, when the assembly reaches the bottom of the post, the pins will be seated in the slots.
4. Using tweezers actuate the walking beam to insure that both shutter blades move.
5. Install the special shutter housing and adjust the blade speed. Final adjustments not yet determined.
6. Use tweezers and move the solenoid plunger to the bottom of its stroke. Make certain that the shutter blades completely close.
7. In the bottom edge of the shutter casting install the single screw to secure solenoid no. 1.
8. The cam follower assembly includes the interceptor which must reach under the pull-down bar of solenoid no. 2. Use tweezers and slide the interceptor under the bar. At the same time position the cam follower so that its slot is centered over the threaded hole in the mounting post.

9. Install the focus-wheel pivot into the threaded hole and tighten the pivot with Special Tool #11655.
10. Using a miniature nut driver, install and tighten the trim-link standoff.
11. Place the trim link over the standoff and engage the pin with the slot in the cam follower.
12. Install and tighten the retaining screw in the standoff. (On some models install the snap ring.)
13. Install the compression spring into the positive-stop-spring socket in the shutter casting.
14. Insert the stop pin on top of the compression spring.
15. Identify the cam-follower-to-positive-stop-pin spring.
16. Hook one end of the spring into the hole adjacent to the adjusting screw in the top of the cam-follower assembly.
17. Hook the other end of the spring onto the positive stop pin.
18. Rotate the lens mount clockwise to its stop (infinity), then rotate counterclockwise three gear teeth.
19. Examine the bottom side of the focus wheel. Note that it has a spiral groove and two rectangular depressions. One is positioned close to the spiral groove. The positive stop pin must engage the other rectangular depression (the one farthest from the spiral groove). The pin on the cam follower must engage the spiral groove. Install the wheel so that the foregoing requirements are met.
20. Install the hex-head focus wheel retaining screw. Use Special Tool #11655. Tighten the hex-head screw.
21. Set the trim wheel at its normal position.
22. Set the trim assembly on the casting so that the two locating studs enter the locating holes in the casting.
23. Check to see that the plastic stud on the trim wheel mates with the slot in the trim link.
24. Install and tighten the two retaining screws.
25. Check the operation of the trim wheel.
26. Rotate the lens and the focus wheel to their clockwise stops.
27. Install the idler gear on its post. If the idler gear was previously adjusted it will be necessary to see that the gear teeth are all engaged. If the idler gear is new, the foregoing may not be required because the gears have not been adjusted to mesh.

    NOTE: Whenever the idler gear and/or focus wheel is replaced, the lens must be collimated. See Section III.
28. Install the idler gear retaining ring.
29. Place the shutter housing in position on the shutter so that the focus and trim wheels protrude through the correct slots.
30. Snap the bottom of the housing over the casting.
31. Install and tighten the two shutter-to-housing screws.
32. Check to see that the four light seals are properly in place on the hinge bracket.
33. Position the shutter on the hinge bracket and align the locating pins.
34. Install and tighten the four retaining screws.
35. Perform lens collimation.
36. Perform the Follow-Focus Test (Section III, Paragraph L).

AO. SOLENOID NO. 2 AND SWITCH S1, REMOVE

NOTE: The retaining screw for switch S1 is inaccessible until solenoid no. 2 is removed.

1. At the back side of the shutter mounting hinge bracket, remove the four screws which secure the shutter to the bracket. Lift off the shutter.
2. Rotate the lens to its clockwise stop.
3. Remove the two retaining screws from the upper corners at the rear of the shutter.
4. Pry each side of the housing away from the casting.
5. Remove the shutter housing from the casting.
6. Place the shutter casting on the hinge bracket and secure with a single screw.
7. Use Special Tool #11655. Remove the focus wheel retainer screw and the focus-wheel pivot.
8. Remove the positive stop pin, cam follower spring, and cam-follower assembly.
9. Using tweezers, reach down into the stop-pin cavity and remove the spring.

   Caution: If the camera contains a ceramic substrate, heat the shutter to 150° F before unsoldering.
10. Unsolder the solenoid no. 2 contacts.

11. Use Tool #11661. Remove solenoid no. 2 retaining nut.
12. Lift out solenoid no. 2.

    NOTE: If switch S1 is faulty, it should be removed at this time.
13. Unsolder the two S1 contacts. If excessive solder has been applied, use solder-wick to remove excessive solder.
14. Turn the shutter over and remove the S1 retaining screw located under the solenoid no. 2 pull-down bar.
15. Remove S1.

AP. SOLENOID NO. 2 AND SWITCH S1, INSTALL

1. If the S1 switch has been removed, place the switch in position and install and tighten the retaining screw.
2. There are two insulated connecting tabs and a short locating stud in addition to the threaded mounting stud. Place the solenoid in position carefully so that the locating stud bottoms in its locating hole.
3. Use Tool #11661. Install and tighten the mounting nut.
4. Turn the shutter over and solder the two solenoid no. 2 connections. (Heat ceramic substrate).
5. The cam follower assembly includes the interceptor which must reach under the pull-down bar of solenoid no. 2. Use tweezers and slide the interceptor under the bar. At the same time, position the cam follower so that its slot is centered over the threaded hole in the mounting post.
6. Engage the trim-link pin in the slot in the cam follower.
7. Install the focus-wheel pivot into the threaded hole and tighten the pivot with Special Tool #11655.
8. Install the compression spring into the positive-stop-spring socket in the shutter casting.
9. Insert the stop pin on top of the compression spring.
10. Identify the cam-follower-to-positive-stop-pin spring.
11. Hook one end of the spring into the hole adjacent to the adjusting screw in the top of the cam follower assembly.
12. Hook the other end onto the positive stop pin.
13. Rotate the lens mount clockwise to its stop and then rotate counterclockwise three gear teeth.
14. Adjust the solenoid no. 2 adjusting nut.
    a. Use a jeweler's screwdriver at the center of the plastic adjusting nut on the hold-down bar and press the bar down as far as it will go.
    b. While holding the bar down, use tweezers and move the follow-focus pin toward the lens and allow it to snap back. There should be no evidence of binding, and the cam interceptor should meet the pin at its mid-point and should not touch the mounting bracket.
    c. After completing the foregoing adjustment, apply a very small amount of Loctite to the adjusting screw.
    d. If the interceptor does not meet these requirements, adjust the solenoid no. 2 adjusting screw to bring the interceptor into the proper position. Recheck the action of the interceptor.
15. Examine the bottom side of the focus wheel. Note that it has a spiral groove and two rectangular depressions. One is positioned close to the spiral groove. The positive stop pin must engage the other rectangular depression (the one farthest from the spiral groove). The pin on the cam follower must engage the spiral groove. Install the wheel so that the foregoing conditions are met.
16. Install and tighten the hex-head focus wheel retaining screw. Use Sprcial Tool #11655.
17. Rotate the lens to its clockwise stop.
18. Place the housing in position on the shutter so that the focus and trim wheels protrude through the correct slots.
19. Snap the bottom of the housing over the casting.
20. Install and tighten the two shutter-to-housing screws.
21. Check to see that the four light seals are properly in place on the hinge bracket.
22. Position the shutter on the hinge bracket and align the locating pins.
23. Install and tighten the four retaining screws.
24. Perform lens collimation(Section III, Paragraph D).
25. Perform complete comprehensive test series. (Section III, Paragraph F).

AQ. FRONT AND REAR LENS ELEMENTS, SEPARATING

If dirt should accumulate between the front and rear lens elements, proceed as follows:

1. Set the lens at the infinity position.
2. Use a grease pencil and mark the rim of the lens at the four o'clock position.
3. Rotate the focusing wheel to set the lens at 10.4 inches.
4. Use Bristol screwdriver no. 11753. On the underside of the shutter housing loosen the idler gear screw.
5. With the thumb and finger unscrew the front lens element.

AR. FRONT LENS ELEMENT, REPLACING

1. Clean as required. Use lens cleaning fluid and lens tissue.
2. Position front element with the grease-pencil mark at 4 o'clock and screw the lens into position. If the lens is started in the correct position, the pencil mark should fall at 4 o'clock when the lens reaches infinity.
3. Perform lens collimation (Section III, Paragraph D).

AS. CLEANING AND LUBRICATING LENS BARREL THREADS

A common malfunction which causes sticking or binding of the focus wheel can be traced to the threads of the lens barrel. When it is known that the focus wheel is not at fault, clean and lubricate the threads as follows:

1. See Paragraph AQ above and remove the lens assembly.
2. With the Q-tip clean the threads of the barrel.
3. Apply thread lubricant with a small brush similar to a woman's finger nail polish brush.
4. Use a hand held hair dryer with medium heat and thoroughly dry the lubricant.
5. Clean lens inner surface with a Q-tip.
6. Reinstall per Paragraph AR, sentences 2 and 3.

AT. INNER FRAME BOW PROCEDURE

Occasionally, the finished picture shows incomplete development in the corners. To correct this condition, use the following procedure:

1. Remove the front cover and test with the Inner Frame Bow Gauge, Special Tool #11823. Hold the camera with the left hand, insert the gauge and exert pressure on the center of the gauge. The reading will be between +.004 inches and +.011. See Figure 4-120.

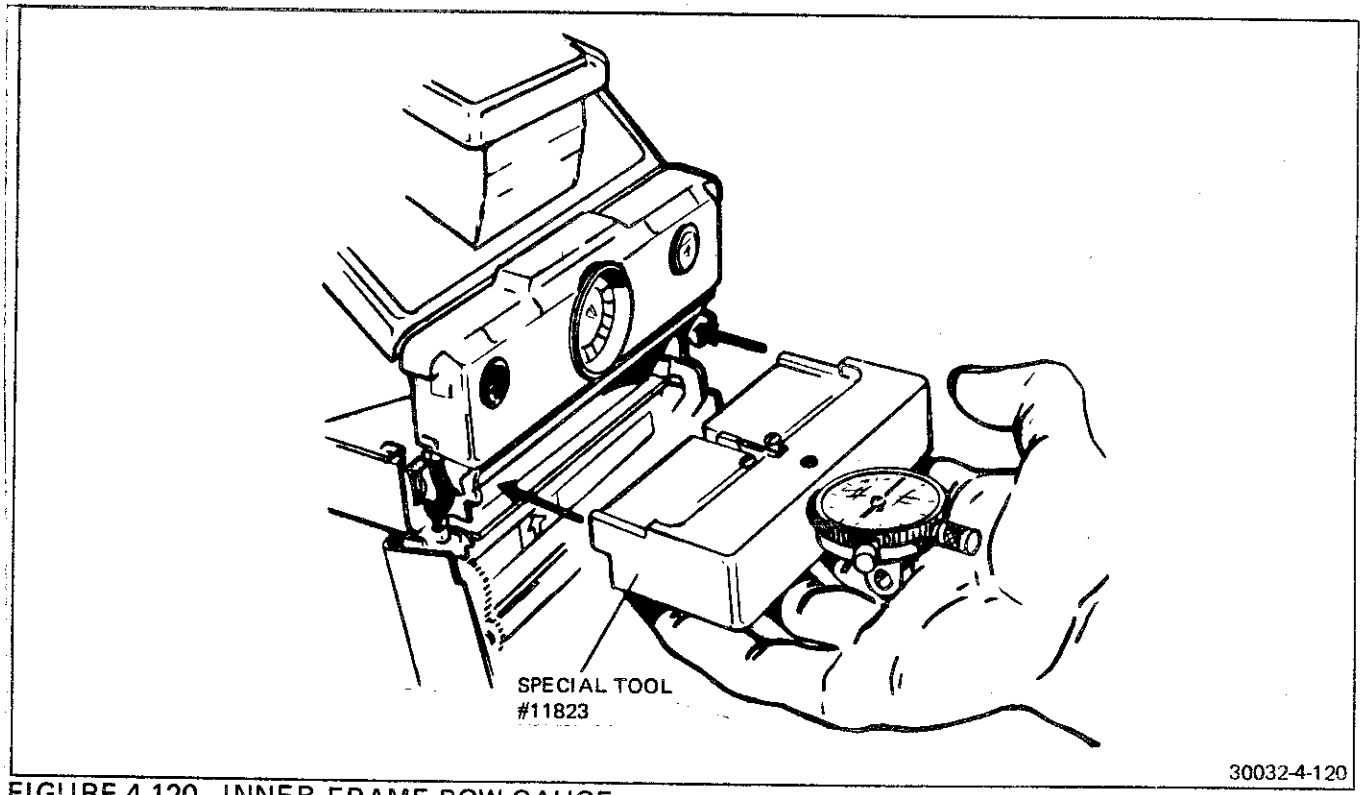
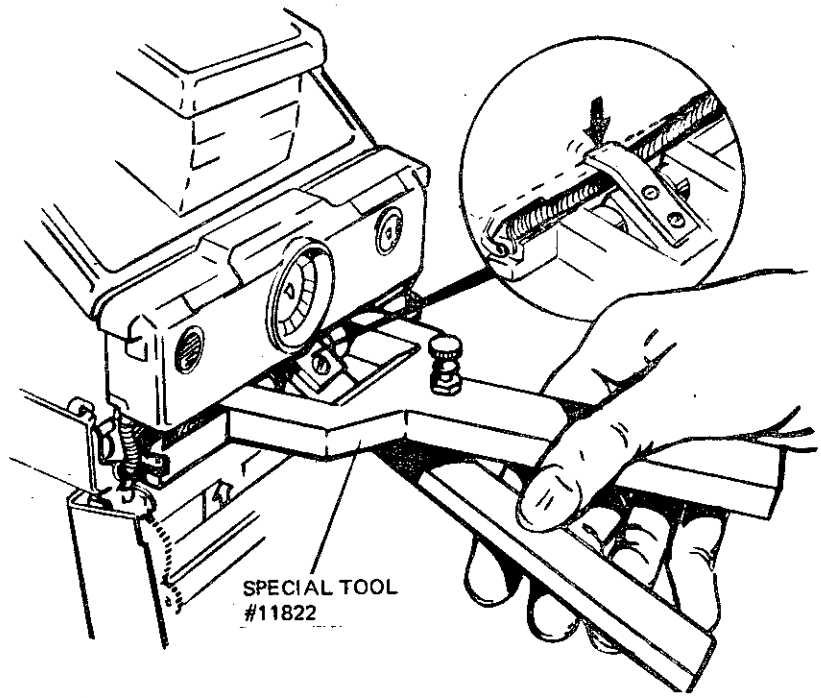


FIGURE 4-120 INNER FRAME BOW GAUGE

2. If the reading is below +.004 inches, use the Inner Frame Bender, Special Tool #11822, bend to specifications and retest (Fig. 4-121).
3. If the reading is above +.011 inches, use your thumb or index finger to press against the inner frame to bring the reading within the upper limit.
4. When inner frame bow setting is according to above, check for flare baffle movement.
   a. Insert an empty film pack.
   b. Go through dark slide eject.
   c. Cover photocell.
   d. Press S1.
   e. Remove film pack.
   f. Examine interior. Flare baffle should **not** be visible.
   g. If the baffle can be seen, it is hinge bound and must be repaired or replaced.

The two special tools are preset and calibrated at Waltham. The Gauge, no. 11823, should be checked monthly with a flat metal master and the dial reset if necessary. The Bender, Tool #11822, has a thumbscrew adjustment. Clockwise rotation reduces the amount of bending.

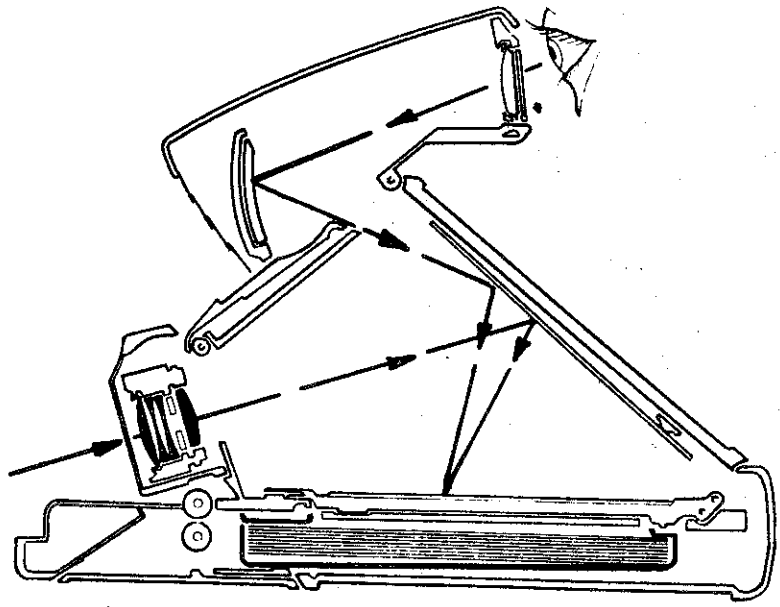
Caution: The camera is more likely to break with counterclockwise screw rotation. Tighten the lock nut and test for correct operation.



30032-4-121

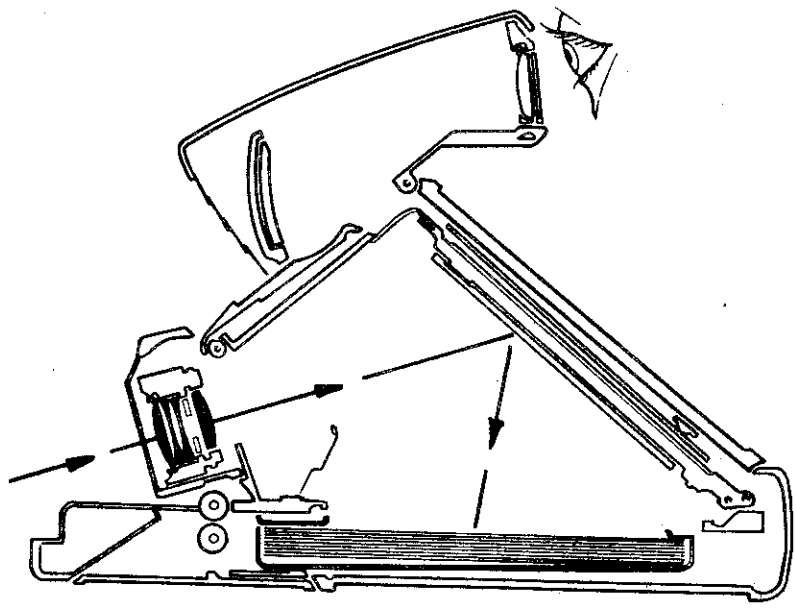
FIGURE 4-121 INNER FRAME BENDER

A



SHUTTER OPEN
(VIEWING MODE)

B



FILM BEING EXPOSED
(EXPOSURE MODE)

30032-1-8

FIGURE 1-8 VIEWING AND SHOOTING

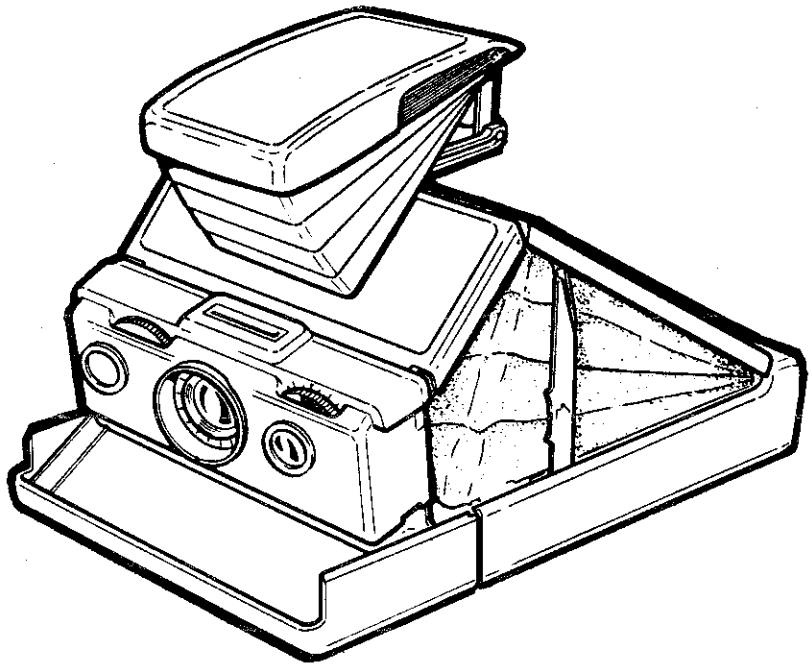
The shutter opens and closes to perform the exposure function.

A first-surfaced mirror is fastened to the underside of the Fresnel viewing screen assembly. The image is reflected by the mirror onto the film surface. The electronic metering system determines the required exposure, and programs the shutter opening and duration accordingly.

REPAIR MANUAL

SX-70 CAMERA

1st. REVISION: NOVEMBER 1973



PARTS LIST

V - CONFIGURATION CONTROL

INTRODUCTION

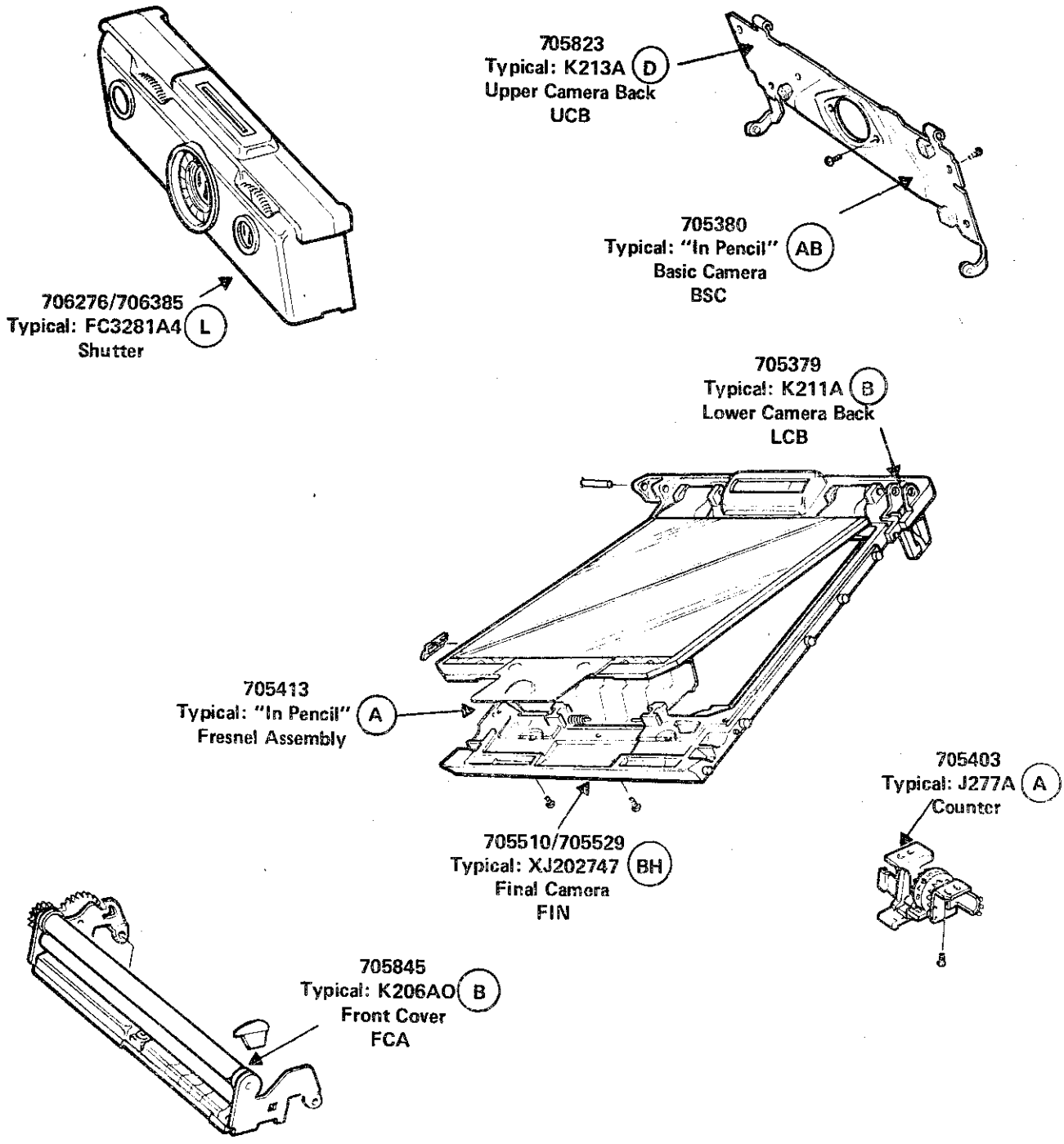
This section of the Manual is devoted to the illustrated (exploded view) drawings of parts, sub-assemblies and assemblies. It supports the same purpose as the familiar parts lists of previous Manuals but goes much deeper because of the complexity of the SX-70 and the 'state of the art' approach to its manufacture. To use this section for ordering replacement parts or stocking your facility, find the basic assembly – for instance – the SHORT COVER ASSEMBLY – turn to that page and figure number (Figure 5-3) and note the exploded view of the assembly. Check the part and the key number and find that number in the numerical list of parts. Along the line opposite the key number you will find all the data on that part. Under the configuration use and reference data heading is listed the configuration 'where used' letters. That means use of that part is restricted to those configurations. Any special uses or detailed information available in the Manual is referenced by figure or page number. The latest changes not yet incorporated are indicated by Repair Information Bulletin (RIB) numbers. These Bulletins must be consulted to keep you up to date on changes as they occur. As further revisions, parts changes, etc. happen – the Manual – especially this section will be revised to KEEP you current. The QUANTITY listed is the minimum required. A blank means a quantity of ONE.

See sheet titled CONFIGURATION LOCATIONS for directions on finding the configuration markings. Also included here are pages delineating configuration changes, explanation of revision impacts and listing by major assemblies.

The following abbreviations are used:

FIN	–	FINAL CAMERA ASSY
BSC	–	BASIC CAMERA ASSY
LCB	–	LOWER CAMERA BACK
UCB	–	UPPER CAMERA BACK
IFA	–	INNER FRAME ASSY
BP/OP	–	BOTTOM PLATE/OUTER PLATE ASSY
FCA	–	FRONT COVER ASSY
SCA	–	SHORT COVER ASSY
BCA	–	BOTTOM COVER ASSY

CONFIGURATION LOCATIONS

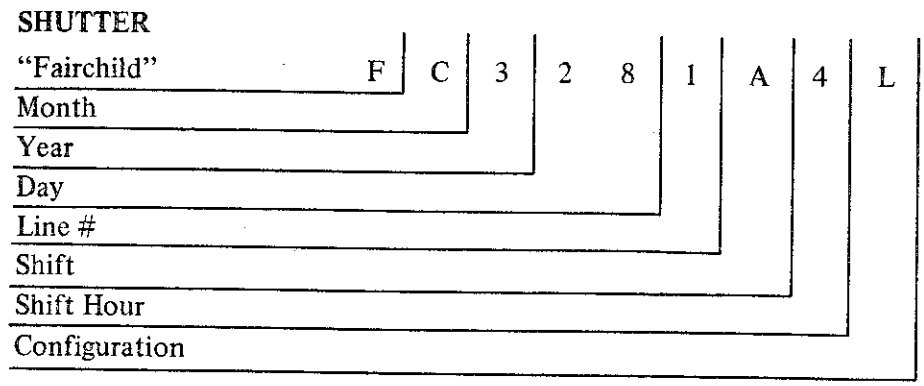


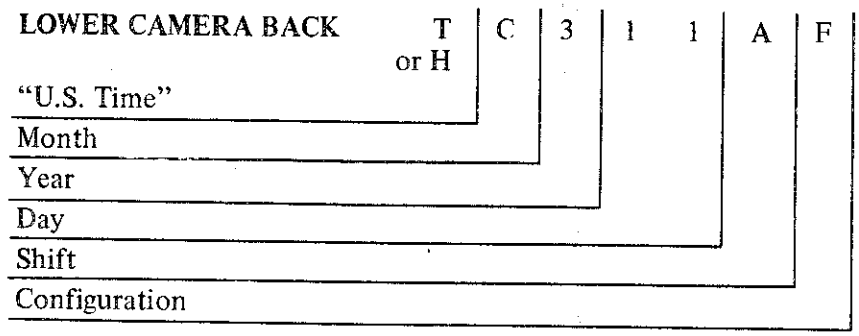
NOTE: 1. The Configuration letter in this illustration is circled.

2. More recent cameras have the final camera S/N located on the Mirror Cover on the gear train side. The basic camera S/N on those cameras is located on the inner frame where the final camera S/N was located.

CONFIGURATION IDENTIFICATION

Below is a breakdown of typical assembly identification numbers. The last letter, or two letters identify the configuration of that assembly.





SHUTTER INTERCHANGEABILITY – MODIFICATION

Defective Shutter Configuration		*Replacement & Modification
F	to	L use 705439 Front Cover Assy. (Conf. "C")
G	to	L use 705439 Front Cover Assy. (Conf. "C")
H	to	L use 705439 Front Cover Assy. (Conf. "C")
J	to	L use 705439 Front Cover Assy. (Conf. "C")
K	to	L use 705439 Front Cover Assy. (Conf. "C")
L	to	P Change 1) to Hinge Bracket 705893 2) to Flex Circuit 705442 3) T.I. only to MCC 705886
L (Fairchild only)	to	M change to Hinge Bracket 705893
M	to	P (Fairchild only) change to Flex Circuit 705442
N		M
P		P

*Fairchild should be replaced with Fairchild, & T.I. with T.I. to avoid further modification

FIGURE 5-1 CAMERA ASSEMBLY

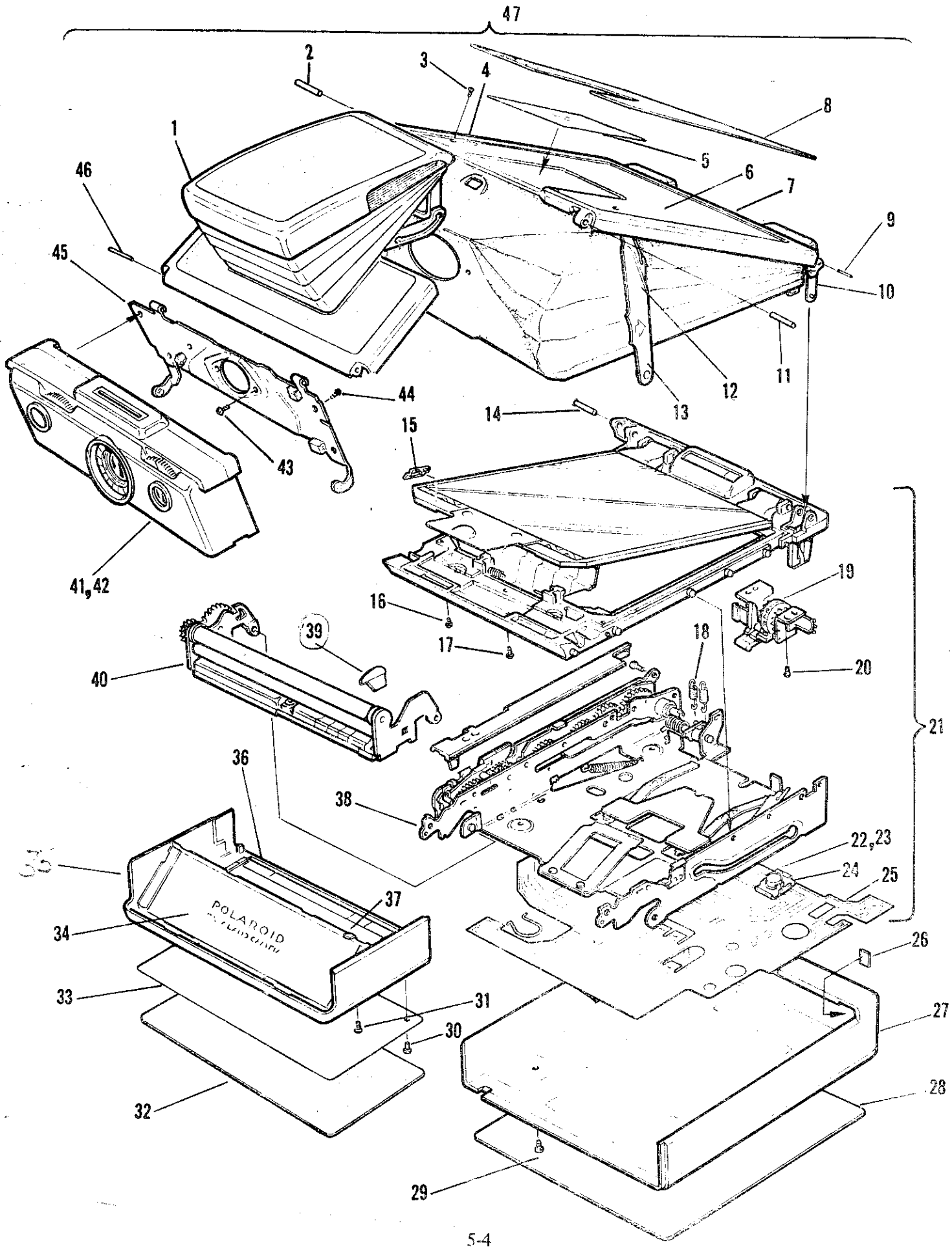


FIGURE 5-1 FINAL CAMERA ASSEMBLY

Part Numbers: 705510 and 705529 E-DH
705437 and 705438 DJ-EH*

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
1	705513	Scrap Short Cover Assembly (Obs.)	C through G (UCB)
1	705445	Short Cover Assembly	H-J (Wafer Lens – Figures 2-4/3-9)
1	705551	Short Cover Assembly, Thick	K (Wafer Lens)
1	705612	Short Cover Assembly	AA-AC (Split Fresnel)
2	705715	Hinge Pin, Left	All
3	705063	Screw, Detent Insert	All Quantity 2
4	705831	Detent Insert	All
5	705757	Decal, Mirror Cover	All
6	705079	Screw, Erecting Link	All Quantity 2
7	705412	Mirror Cover Assembly	C through G (UCB)
7	705446	Mirror Cover Assembly	H-J-K-M-AA (page 4-3)
8	705186	Mirror Cover Leather Insert	All
9	705033	Cam Pin, Safety Switch	All
10	705199	Actuator, Safety Switch	All
11	705716	Hinge Pin, Right	All
12	705724	Spring, Erecting Link	All
13	705294	Assembly, Erecting Link	All
14	705132	Hinge Pin, Left	All
15	705247	Safety Latch	A through E (LCB)
16	705044	Screw	All Quantity 2
17	705061	Screw	All
18	705198	Override Spring	A through AD-AJ-BB-BC-BD-BF (BSC)
18	705902	Override Spring	AE through AK-BA-BE-BG through BM (BSC)
19	705403	Counter Assembly	A through E (LCB)
19	705863	Counter Assembly	F through J (LCB) (RIB No. 27)
20	705169	Screw	All Quantity 6
21	705379	Lower Camera Back Assembly	A through AE + BB (BSC)
21	705451	Lower Camera Back Assembly	AF-AH-BA-BC-BD-BE-BK-BL-BM (obsolete)
21	705477	Lower Camera Back Assembly	BF-BG (BSC)
21	705473	Lower Camera Back Assembly	BH-BJ (BSC) (RIB #48)
22	705819	Motor Control, F	Used with Shutters F through P-T1 or F
22	705886	Motor Control, T	Used with Shutter P
23	705817	Motor Control, T	Used with Shutters F through L
24	705808	Component Holder	All
25	705540	Flex Circuit	DJ-DK-EA-EC-EG (FIN)(obsolete)
25	705442	Flex Circuit	EF-EH (FIN)
25	705329	Flex Circuit	B through EE (FIN)
26	705168	Counter Lens Window	All
27	705538	Bottom Cover Assembly, Thick	Use with FCA-D
27	705295	Bottom Cover Assembly, Thin	Use with FCA-B or C

*EH is last assigned for final camera assemblies.

FIGURE 5-1 FINAL CAMERA ASSEMBLY (Continued)

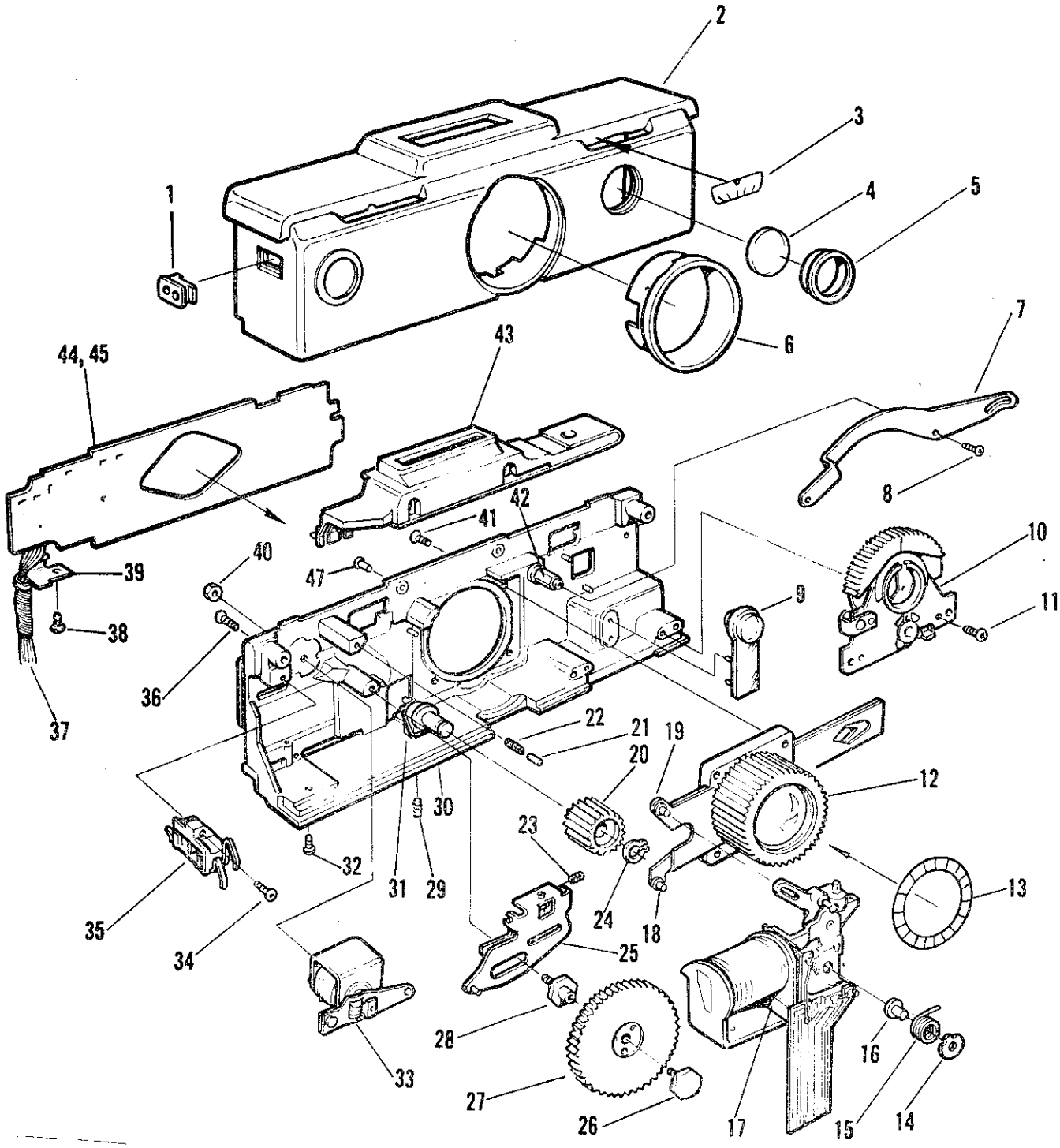
Part Numbers: 705510 and 705529 E-DH
705437 and 705438 DJ-EH*

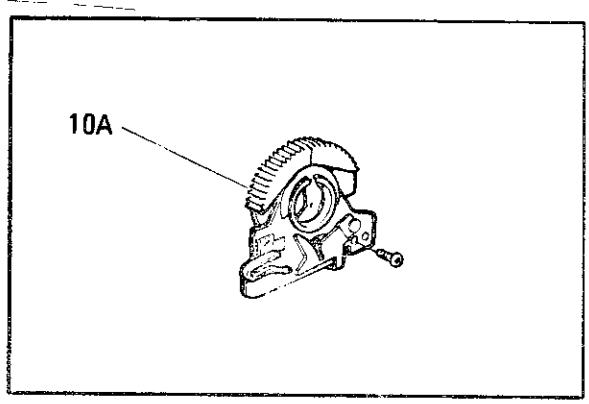
KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
28	705188	Bottom Cover Leather Insert	All
29	705021	Screw, Bottom Cover	All Quantity 4
29	705889	Screw, Bottom Cover	All Quantity 4
30	705895	Rivet, Film Catcher Spring	D Quantity 4
30	705081	Rivet, Film Catcher Spring	B-C Quantity 4
31	705022	Screw, Front Cover	All Quantity 2
32	705189	Front Cover, Leather Insert	All
33	705361	Film Catcher Spring	B-C-D
34	705858	Decal, Light Shield	All
35	705845	Front Cover Assembly, B	Used with Shutts F through K
35	705439	Front Cover Assembly, C	Used with Shutts L-M-N-P (obsolete)
35	705437	Front Cover Assembly, D	Figure 4-106 (obsolete)
35	705539	Front Cover Assembly, D	Use with BCA 705538
36	705758	Front Cover Decal	All
37	705372	Cam, Light Shield	B
37	705386	Cam, Light Shield	C-D (Figure 4-107)
38	705512	Bottom Plate/Out Pl Assembly	A through E (LCB)
38	705544	Bottom Plate/Out Pl Assembly	F-G-H (LCB) (obsolete)
39	705900	Light Seal	All (Figure 4-2)
40	705416	Spread System Assembly	All
41	706437	Shutter Assembly T	Used with F-C-A C or D
41	706276	Shutter Assembly T No Longer Used	Used with FCA B
41	706472	Shutter Assembly T	Used with FCA C or D
42	706385	Shutter Assembly F No Longer Used	Used with FCA B
42	706438	Shutter Assembly F	Used with FCA C or D
42	706477	Shutter Assembly F	Used with FCA C or D
42	706478	Shutter Assembly F	Used with FCA C or D
43	705053	Screw, Shutt Bkt to Boot	All Quantity 2
44	705056	Screw, Shutter Mtg	All Quantity 4
45	705297	Shutter Hinge Bracket Assembly (705330-Less Gaskets)	C through H (UCB)
45	705893	Shutter Hinge Bracket Assembly	J-K-M-AA (UCB) (RIB No. 26)
46	705717	Hinge Pin, Bkt to SCA	All Quantity 2
47	705823	Upper Camera Back Assembly	C through H (Order by components)
47	705464	Upper Camera Back Assembly	J (Order by components)
47	705468	Upper Camera Back Assembly	K (Order by components)
47	705613	Upper Camera Back Assembly	M, AA through AC (Order by components)

*EH is last assigned for final camera assemblies.

SHUTTER ASSEMBLY

FIGURE 5-2 BASE LINE SHUTTER ASSEMBLY





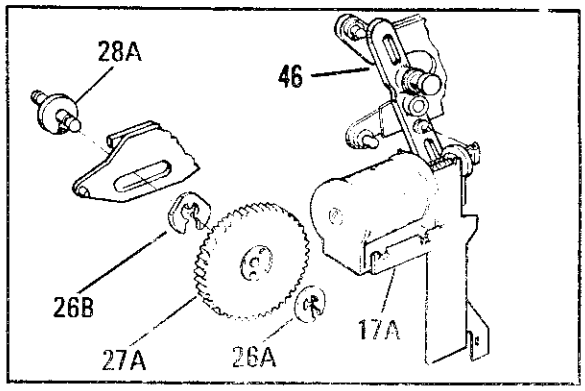


FIGURE 5-2 SHUTTER ASSEMBLY

Part Numbers: 706276/706385 F through K
706437/706438 L
706472/706478 P
706477 M
706482 N

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
1	706854	S1 Insulator	All
2	706326	Shutter Front Housing	F through K (obsolete)
2	706454	Shutter Front Housing	L through P
3	706788	Decal, Trim	All
4	706294	Photocell Window	Materials Information Bulletin No. 4
4	706894	Photocell Window (Diffused Filter)	Materials Information Bulletin No. 4
5	706823	Photocell Bezel	All
6	706714	Lens Bezel	All
7	706268	Trim Link	All
8	706072	Screw, Trim Link	F
8	706096	Retaining Ring, Trim Link	G through P
9	706177	Photocell Lens	All
10	706821	Trim Mounting Plate Assembly	F through K (obsolete)
10A	706436	Trim Mounting Plate Assembly	L through P
11	706713	Screw, Trim Plate	All Quantity 2
12	701202	Lens Assembly	All
13	706819	"A" Element Decorative Plate	All
14	706845	Retaining Cap	All
15	706739	Opening Spring	F through M
15	706885	Opening Spring	N-P
16	706782	Plug, Opening Spring	F through M
17	706344	Solenoid 1, Blade Drive Assembly	F through M
17A	706465	Solenoid 1, S4 Outline	P
18	706278	Rear Blade Assembly	F through M
18	706448	Rear Blade Assembly	N-P
19	706277	Front Blade Assembly	F through M
19	706447	Front Blade Assembly	N-P
20	706192	Idler Gear	All
21	706074	Positive Stop Pin	F through M
21	706931	Positive Stop Pin	N-P
22	706730	Compression Spring	All
23	706875	Extension Spring, Follow Focus	F through M
23	706937	Extension Spring, Follow Focus	N-P
24	706093	Idler Gear Retaining Ring	All
25	706280	Cam Follower Assembly	F through M (obsolete)
25	706946	Cam Follower Assembly	N-P
26	706065	Screw, Focus Wheel Retaining	F through M
26A	706629	Retaining Ring, Focus Wheel	N-P

The incorporation of a mirror in the lens-to-film path is necessitated by the nature of the film. No separate negative is employed. Instead, the image appears as a direct positive. Since the final product is an opaque print, it is viewed by reflection. As a result, the mirror is needed to reverse the image so that the final print will be properly oriented. This requirement, in turn, dictates the use of the reflectance type viewing screen rather than a ground-glass type transmission system.

Note that the film surface is displaced from the Fresnel viewing screen by the thickness of the viewing screen assembly. The correct focal distance for both viewing and exposure is properly maintained, however, since the surface-coated exposure mirror is displaced by the same dimension.

A light stop is provided in the viewing system. This light stop is closed as the viewing screen/mirror moves to prevent light through the hole in the boot from striking the film during exposure.

As indicated by the foregoing description, the viewing system is blacked out during the actual exposure.

As soon as the exposure is complete the mechanism returns the viewing screen to its initial position and the pick feeds the exposed film to the spreader rolls. The rolls break the pod, spread the developer, and eject the film from the camera.

7. Completing the Filmpack

As each exposure is completed, the exposure counter subtracts one digit until the ten exposures have been made. The counter then indicates (0). When this occurs, switch S9 is closed.

As previously mentioned, certain deviations can occur in the automatic counting system. Since the counting cycle is initiated by the insertion of a film pack, the pack may not necessarily contain a full supply of film. If, for some reason, a partially used pack is removed and reinserted, the top film will be the dark slide. The counter will start at number 10. Since switches S8 and S9 are physically attached to the counter, the camera will cycle through 10 exposures even though there be less than 10 sheets of film in the pack. This deviation must be recognized whenever a partially exposed pack is used.

8. Developing the Print

As in other Polaroid pack cameras, the picture is developed outside the camera. Unlike previous Polaroid Land Cameras, however, there is no negative to peel off and discard.

Thus, there is no requirement for a timing cycle. The nature of the film is such that, once delivered from the camera, the picture will assume its final appearance automatically with no further attention by the operator.

9. Exposures Using Flash

The SX-70 accepts a special 10-lamp flash bar that plugs into a receptacle directly over the camera lens. There are five lamps in a row on either side of the bar which must be removed, rotated, and reinserted after the fifth lamp has been fired (Figure 1-9).

Inserting a flash bar into the flash socket closes switch S2 in the socket. This action sets up the shutter electronic circuit to permit firing of the flash lamp. A follow-focus mechanism, coupled to the lens focusing system arrests the shutter blades at an opening related to camera-to-subject distance. The light measuring circuits remain active, however, so that if ambient light level is sufficiently high to produce adequate exposure, the lamp may not fire. If the array has been exhausted, the shutter will complete the exposure cycle without flash. Maximum exposure duration is twenty seconds.

When the exposure counter reaches 0 (empty) the camera will not fire a flash lamp even though unused lamps remain in the bar. The previously discussed deviation associated with the exposure counter is applicable to the flash functions. If an unused lamp is in position and if a partially empty film pack has been reinserted, the camera will continue to fire lamps after the last sheet of film has been exposed, until the counter reaches zero.

10. Closing the Camera

When through using the camera it can be folded and latched in its closed configuration by pushing the erecting link. When the camera is closed, the interlock switch (S6) is opened so that the battery is completely disconnected from the camera circuits. The trim wheel (the lighten/darken adjustment associated with the photocell) automatically returns to its normal position each time the camera is closed.

C. SHUTTER DESCRIPTION (AMBIENT LIGHT MODE)

The shutter employed in the SX-70 camera is unique. No direct comparisons should be drawn between the manner in which it functions and the function of other Polaroid electronic shutters.

FIGURE 5-2 SHUTTER ASSEMBLY (Continued)

Part Numbers: 706276/706385 F through K
706437/706438 L
706472/706478 P
706477 M
706482 N

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
26B	706628	Retaining Ring, Follow Hinge	N-P
27	706329	Focus Wheel	F through M-PP11
27A	706329	Focus Wheel	N-P PP-12
28	706191	Focus Wheel Pivot	F through M
28A	706929	Focus Wheel Pivot	N-P
29	706781	Screw, Idler Gear	All
30	706190	Stud, Idler Gear	All
31	706780	Spring, Idler Gear	All
32	706066	Screw, SOL No. 1	F through M
32	706635	Screw, SOL No. 1	N-P
33	706341	Pull Down Assembly, SOL No. 2	All
34	706085	Screw, S1 Housing	All
35	706384	Remote Control S1 Assembly	All
36	706087	Screw, Shutt Front Housing	All
37	706858	Cable and Retainer Assembly	F through N
37	706933	Cable and Retainer Assembly	P
38	706097	Screw, Retainer	All
39	706806	Cable Retainer	All
39	706851	Cable Retainer, Metal	All
40	706067	Hex Nut Solenoid No. 2	All
41	706068	Screw, Lens Housing	All
42	706710	Standoff, Trim Link	All
43	706367	Pillar Socket Assembly	F through M
43	706941	Pillar Socket Assembly	N-P
44	706376	Ceramic and Cable Assembly T	F through L (not available)
44	706855	Printed Circuit Board and Cable F	F through L (not available)
44	706945	Printed Circuit Board and Cable F	M-N (not available)
44	706936	Printed Circuit Board and Cable F	N (not available)
44	706925	Printed Circuit Board and Cable F	P (7 Wire) (RIB No. 33) (not available)
45	706924	Ceramic and Cable Assembly T	P (not available)
46	706457	Walking Beam Assembly	N-P
47	706608	Rivet	All

Figure 4-31

Quantity 4

SHORT COVER ASSEMBLY

FIGURE 5-3 SHORT COVER ASSEMBLY

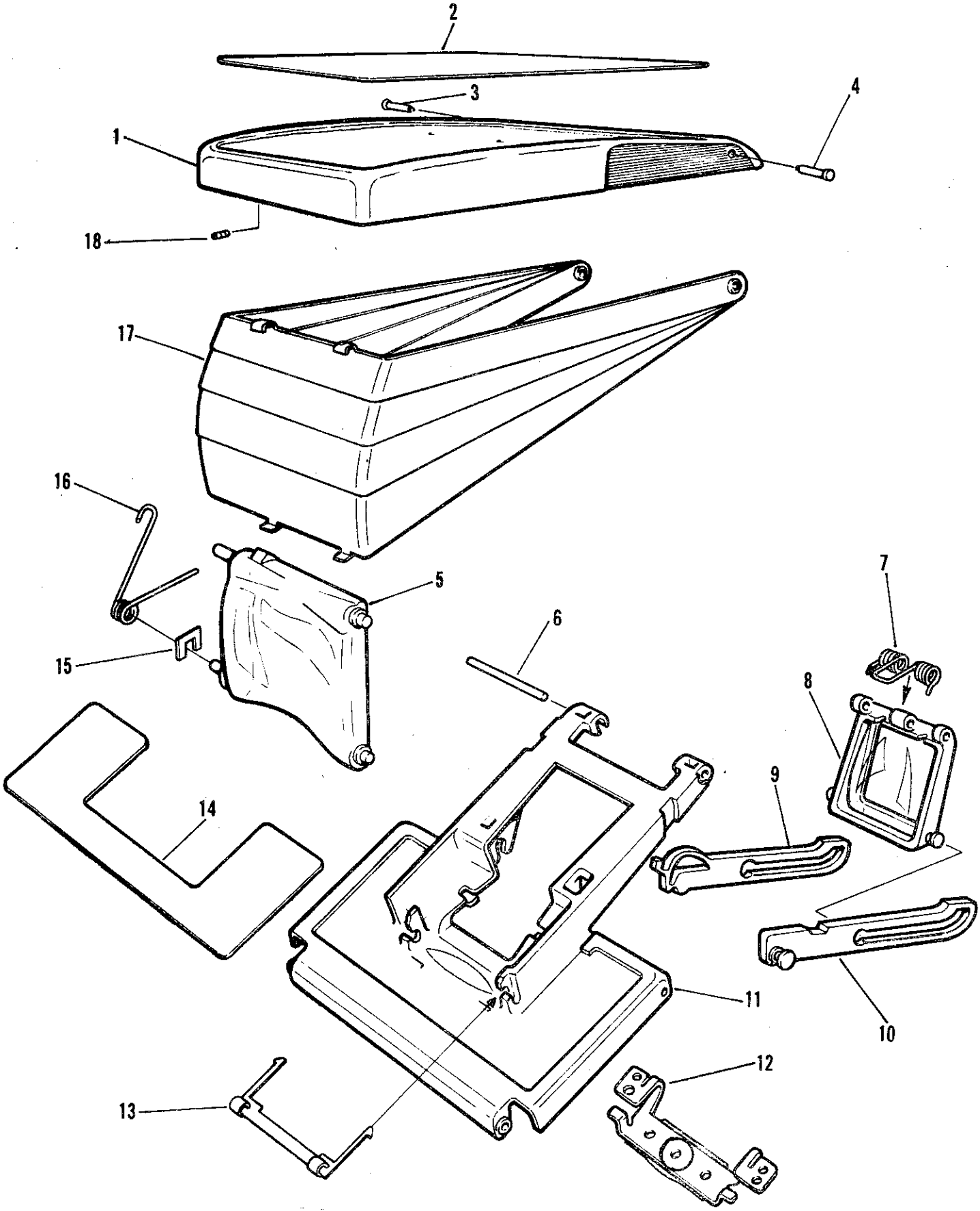


FIGURE 5-3 SHORT COVER ASSEMBLY

Part Numbers: 705513 C through G
705551 K
705445 H and J
705612 AA and AC

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
1	705828	Viewfinder Cap Assembly	C through J (UCB) (replaced)
1	705537	Viewfinder Cap Assembly	K (UCB)
2	705185	Leather Insert, VF Cap Assembly	C through J (UCB)
2	705899	Leather Insert, VF Cap Assembly	K (UCB) (replaced)
3	705848	Pin, R.H., VF Cap	All
4	705849	Pin, L.H., VF Cap	All
5	705292	Concave Mirror Assembly	All
5	705482	Concave Mirror Assembly	All Interim
5	705609	Concave Mirror Assembly	All Final
6	705847	Pivot Pin Eyelens	All
7	705299	Eyelens Torsion Spring	All
8	705293	Eyelens Assembly	C through G (UCB)
8	705396	Eyelens Assembly	H through K (UCB) (replaced)
8	705610	Eyelens Assembly 3°	M through AC (UCB)
9	705245	Eyelens Link, R.H.	All
10	705244	Eyelens Link, L.H.	All
11	705508	Short Cover	All
12	705397	Wafer Support Assembly	H through AC (P4-14) (UCB) (not available)
13	705389	Positioning Spring	All (Figure 4-25)
14	705187	Leather Insert, Short Cover	All
15	705888	Shim	As Required – Red-Blue
16	705287	Concave Mirror Spring	All
17	705336	VF Shade Blade Assembly	All
18	705077	Adjusting Screw	All

FIGURE 5-4 INNER FRAME ASSEMBLY

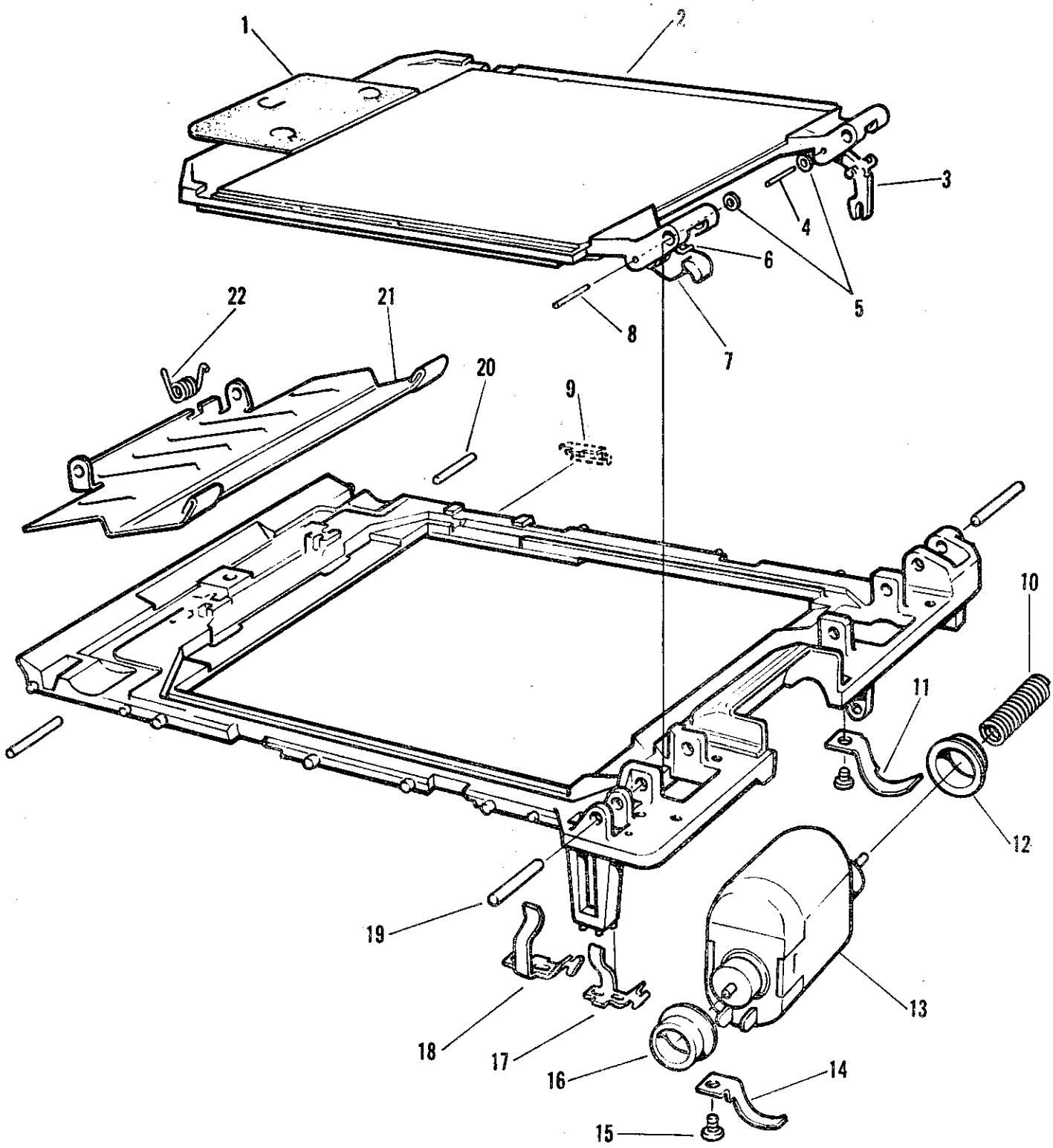
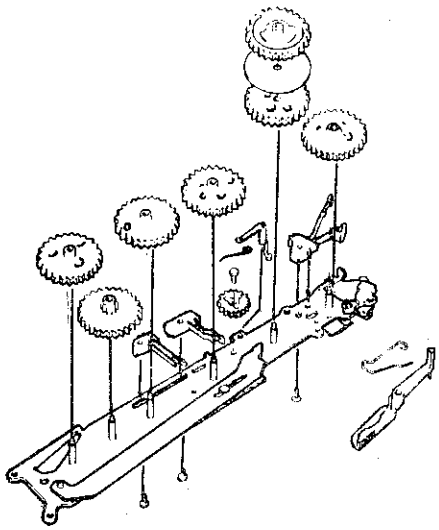


FIGURE 5-4 INNER FRAME ASSEMBLY

Part Numbers: 705511 A through G
705475 H-J

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA
1	705801	Light Stop	All
2	705413	Fresnel Assembly	A through AG and BB (BSC) (replaced)
2	705447	Fresnel Assembly	AH through AK-BA-BC through BM
2	705458	Fresnel Assembly	Split Image
3	705112	Drag Link	A through E (LCB)
3	705897	Drag Link	F through J (LCB) (RIB No. 25)
4	705721	Drag Link Pin	All
5	705798	Spacer, Fresnel	All (As Required)
6	705124	Drive Pawl Spring	All
7	705223	Drive Pawl	All
8	705123	Drive Pawl Shaft	All
9	705247	Safety Latch	A through E (LCB)
10	705128	Flexible Coupling	All
11	705705	Motor Clamp, Right	All
12	705708	Motor Shock Mount, Right	All
13	705289	Motor Assembly	A through G (LCB)
13	705916	Motor Assembly	H-J (LCB)
14	705706	Motor Clamp, Left	All
15	705169	Screw, Motor Assembly, Counter Mounting and Switch S-5	All Quantity 6
16	705707	Motor Shock Mount, Left	All
17	705271	Safety Switch Contact, Right	All
18	705270	Safety Switch Contact, Left	All
19	705134	Hinge Pin, Fresnel	All Quantity 2
20	705281	Baffle Hinge Pin	All Quantity 2
21	705314	Baffle	All (Paragraph P-10, p 4-29)
22	705232	Baffle Spring	All
	705799	Capacitor	All Fairchild

FIGURE 5-5 BOTTOM PLATE/OUTER PLATE ASSEMBLY



OUTER PLATE ASSEMBLY – 57

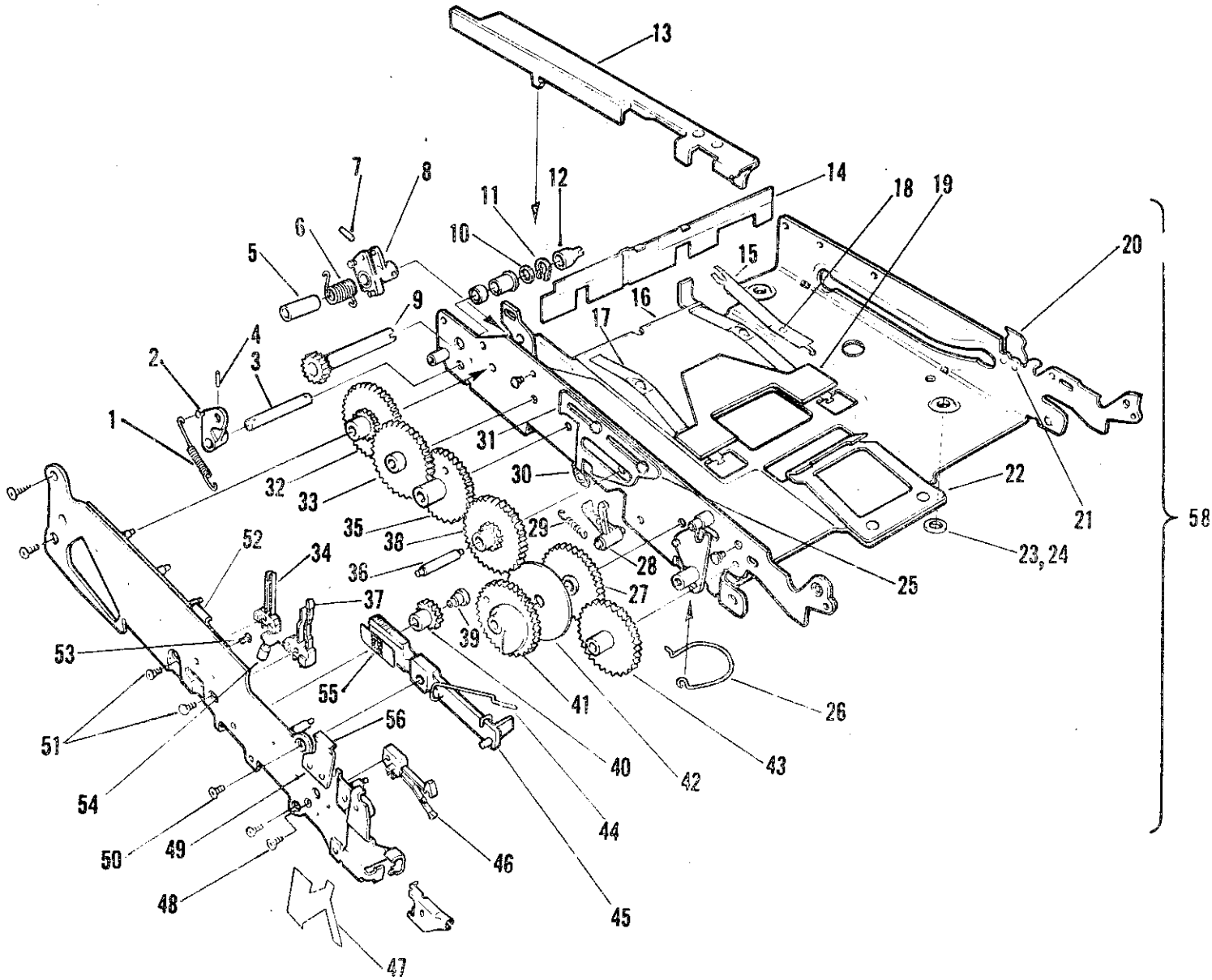


FIGURE 5-5 BOTTOM PLATE/OUTER PLATE ASSEMBLY

Part Numbers: 705512 A through AD-BB
705544 AF through AK-BA-BC through BM

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA	
1	705353	Booster Spring	All	
2	705216	Bell Crank	A through G (LCB)	
2	705914	Bell Crank	H-J (LCB)	
3	705105	Recock Drive Shaft	All	
4	705046	Drive Pin, Crank	All	
5	705269	Sleeve	All	
6	705234	Drive Spring	All	
7	705046	Drive Pin Crank	All	
8	705290	Drag Link, Bell Crank Assembly	A through G (LCB)	
8	705912	Drag Link, Bell Crank Assembly	H-J	
9	705713	Motor Pinion Shaft Assembly	All	
10	705036	Washer	All	
11	705007	Grip Ring, Motor Shaft	All	
12	705871	Coupling Adaptor	All	
13	705420	Gear Cover	All	
14	705755	Plate, Loading Decal	All	
15	705224	Reset Pawl Spring	All	
16	705274	Contact Insulating Strip	All	
17	705272	B Contact	All	
18	705003	Rivet	All	Quantity 3
19	705273	Contact Retaining Block	All	
20	705804	Detent Clip	All	
21	705762	Detent Pin	All	Quantity 2
22	705249	Front Pack Spring	All	
23	705086	Spacer, Black	All As Required	
24	705085	Spacer, White	All As Required	
25	705125	Pick Slide Pin	All	
26	705259	Safety Latch Act Spring	A through E (LCB)	
27	705208	Second Idler Gear	All	
28	705325	Pick Latch	All	
29	705110	Pick Latch Spring	All	
30	705106	Pick Return Spring	All	
31	705222	Pick Assembly	All (Figure 4-3)	
32	705203	First Reduction Gear	All	
33	705204	Second Reduction Gear	All	
34	705318	S-5 Assembly	All	
35	705209	First Idler Gear	All	
36	705104	Gear Pins	All	Quantity 6
37	705317	S-3 Assembly	All (Figure 4-81)	
38	705205	Third Reduction Gear	All	

FIGURE 5-5 BOTTOM PLATE/OUTER PLATE ASSEMBLY (Continued)

Part Numbers: 705512 A through AD-BB
705544 AF through AK-BA-BC through BM

KEY NO.	PART NO.	DESCRIPTION	CONFIGURATION USE AND REFERENCE DATA	
39	705102	Idler Gear Stud	All	
40	705200	Recock Idler Gear	All	
41	705842	Recock Gear Assembly	All	
42	705745	Washer	All	
43	705206	Third Idler Gear	All	
44	705160	Latch Spring	All	
45	705323	Latch	All	
46	705811	S-7 Assembly	All	
47	705851	Cable Cover	All (Figure 4-31)	
48	705060	Screw, Mounting S-7	All	
49	705062	Rivet, Clip to Op	All	Quantity 2
50	705044	Screw, Gear Train	All	Quantity 3
51	705169	Screw, S3-S5, Mounting	All	Quantity 2
52	705301	Recock Ram	All	
53	705722	Ram Slide Pin	All	
54	705799	Capacitor	As Required (Fairchild)	
55	705761	Latch Decal	All	
56	705830	Detent Clip	All	
57	705404	Outer Plate Assembly	All	
58	705543	Bottom Plate Assembly	All (not available)	

DEFINITIONS OF CONFIGURATIONS

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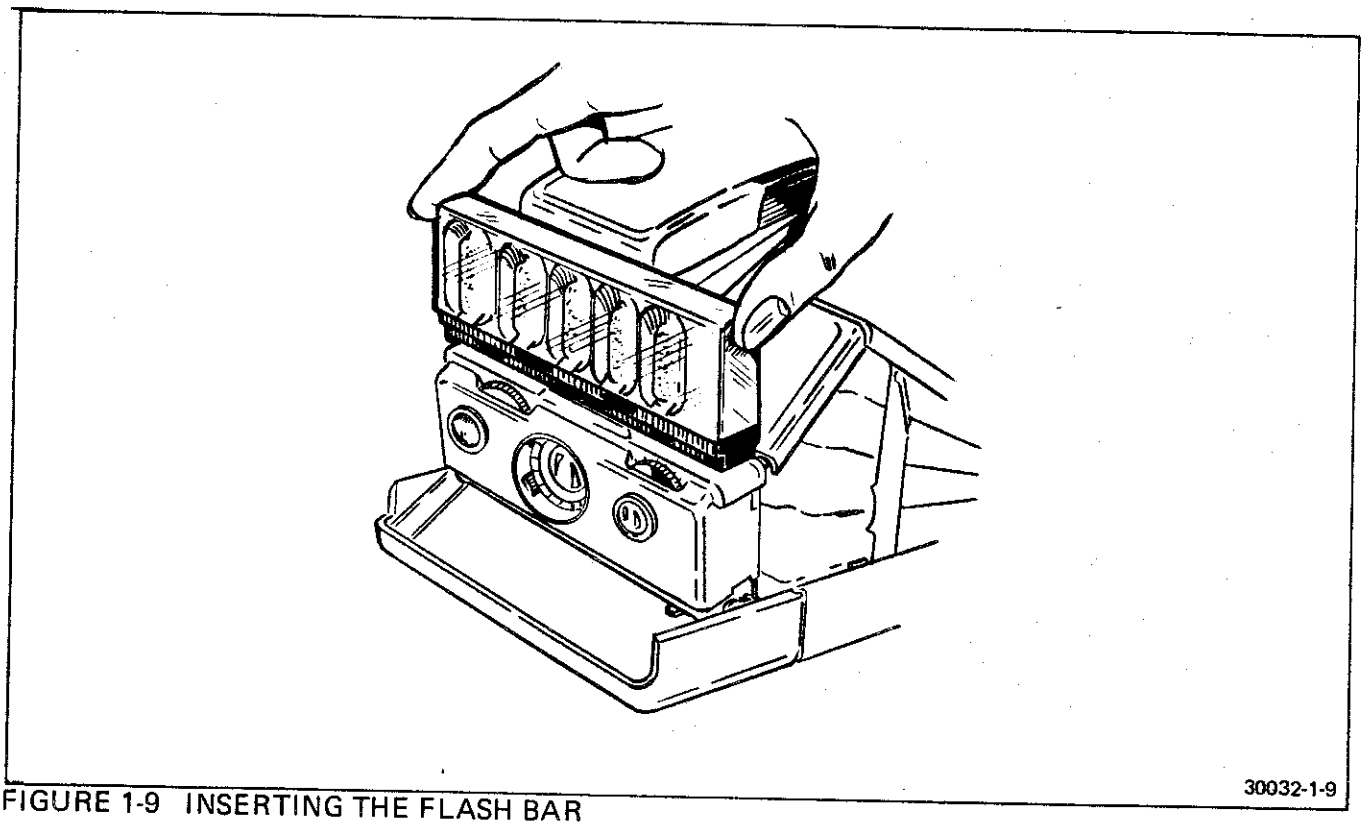
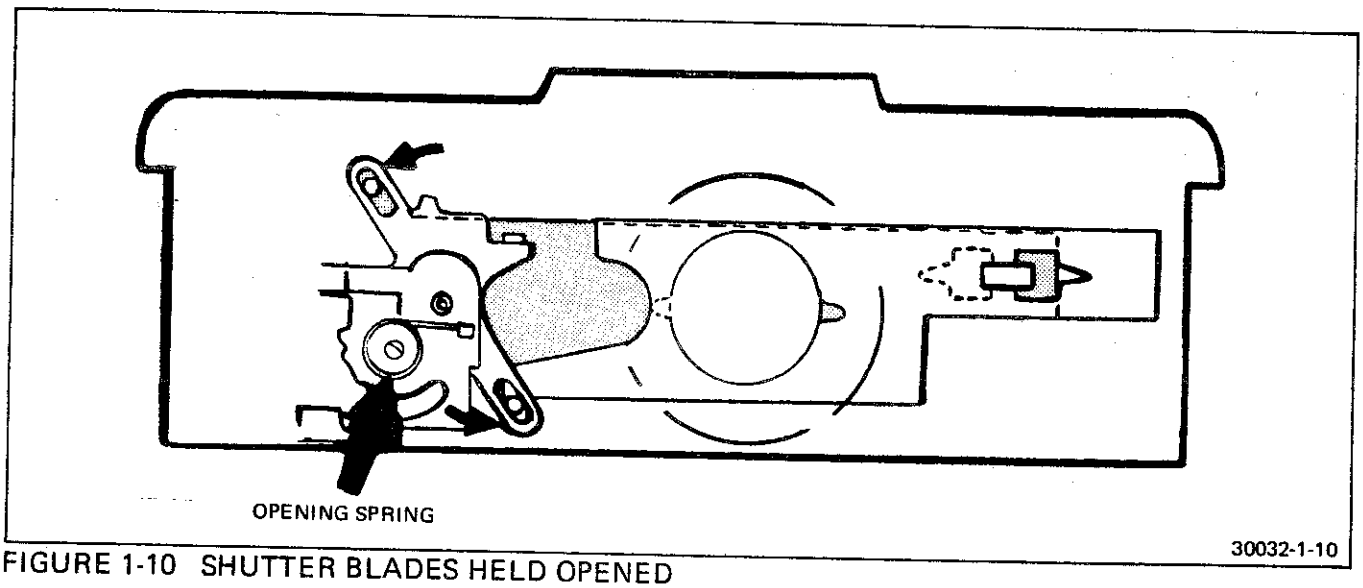
16.	Bottom Plate Assembly	5.30
17.	Front Cover Assembly	5.30



30032-1-9

FIGURE 1-9 INSERTING THE FLASH BAR



30032-1-10

FIGURE 1-10 SHUTTER BLADES HELD OPENED

No manually adjustable or fixed aperture is employed. When a picture is taken, two shutter blades, with specially shaped cutouts, open the lens from a totally closed position to a suitable aperture. The two blades then reverse direction and again shut off the optical path. These same two blades also contain a similar (although differently shaped) pair of cutouts that open and close the light path to the photocell in like manner. In the following description the function of the photocell cutouts is deferred until the action of the shutter cutouts is explained although, in operation, the two functions are interdependent.

When the camera is opened for viewing, but before the release button is pressed, the shutter blade solenoid (no. 1) is de-energized. A spring (opening spring) is holding the shutter blades at their maximum level (Figure 1-10). The lens opening is thus at maximum and provides maximum viewing/focusing brilliance. Solenoid/spring action is discussed in detail in the next section of this manual.

1. DEFINITION OF CAMERA ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Shutter Assembly	Basic Camera Assembly	Front Cover	Features
CK705437 CK705438	L	E or K	C	8 wire cable, Canfield Boot, Slanted switches kick up blades, positive reset trim system
DA705437 DA705438	L	F or AA	C	Same as "CK" except has Dapro Boot
DB705437 DB705438	L	H or AD	C	Same as "CK" except has insert molded boot
DC705437 DC705438	L	J or AC	C	Same as "CK" except has Moxness Skirted Boot
DD705437 DD705438				Not used
DE705437 DE705438	K	G	B	Old boot, old trim
DF705437 DF705438	L	G	C	Old boot, new trim
DG705437 DG705438	L	AE	C	Old counter, new drag link, no wafer
DH705437 DH705438	L	AF	C	New counter, new drag link, no wafer
DJ705437 DJ705438	L M	AG AK	C	Add wafer, new drag link, old counter, old and new gaskets
DK705437 DK705438	L M	AH BA	C	Add wafer, new drag link, new counter, old and new gaskets
EA705437 EA705438	L M or N	AH BA	D	Thick front cover, bottom cover, new counter, new drag link, add wafer, old and new gaskets
EB705437 EB705438	L M	BB AJ	C	Add wafer, old drag link, old counter
EC705437 EC705438	L M	BD BC	C	New counter, old drag link, add wafer, old and new gaskets
ED705437 ED705438	L M or N	BE	D	Split image, new counter, new drag link, add wafer, new gaskets, thick front cover, 8 wire shutter

1. DEFINITION OF CAMERA ASSEMBLY CONFIGURATIONS (CONT'D)

Configuration/ Part No.	Shutter Assembly	Basic Camera Assembly	Front Cover	Features
EE705437 EE705438 EE705470 EE705471	L M or N	 BF	C	Thick VF Cap, old counter, old drag link wafer, new gasket, 8 wire shutter
EF705437 EF705438 EF705470 EF705471	P	BA BH BG BL	C or D	7 Wire shutter, thick or thin FC, BC, old or new counter, thick or thin VF Cap, wafer, new drag link, new gasket
EG705437 EG705438 EG705470 EG705471	L M or N	 BL	D	New counter, thick bottom cover, thick VF Cap, new gasket, wafer, new drag link, 8 wire shutter
EH705437 EH705438 EH705470 EH705471	P	BK	D	Split image, new counter, new drag link, wafer, new gasket, thick FC, BC, thick VF Cap, 7 wire shutter

2. DEFINITION OF BASIC CAMERA ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Upper Camera Back	Lower Camera Back	Fresnel Assembly	Counter Assembly	Features
AD705380	G	C,D,E	A	B	
AE705380	G	F	B	B	Old counter, new drag link, old lens gasket
AF705467	G	F	B	C	New counter, new drag link, old lens gasket
AG705380	H	F	B	B	Old counter, new drag link, wafer change, old lens gasket
AH705467	H	F	B	C	New counter, new drag link, wafer change, old lens gasket
AJ705465	J	C,D,E	A	B	Old counter, old drag link, wafer change, new lens gasket or no gasket
AK705465	J	F	B	B	Old counter, new drag link, wafer change, new lens gasket or no gasket
BA705467	J	F	B	C	New counter, new drag link, wafer change, new lens gasket
BB705380	H	C,D,E	A	B	Old counter, old drag link, wafer change, old lens gasket
BC705467	J	C,D,E	A	C	New counter, old drag link, wafer change, new gasket or no gasket
BD705467	H	C,D,E	A	C	New counter, old drag link, wafer change, old gasket
BE705467	M	F	C	C	New counter, new drag link, wafer change, new gasket or no gasket split image
BF705469	K	C,D,E	A	B	Old counter, thick VF Cap, old drag link, wafer, new gasket
BG705469	K	F or G	B	B	Old counter, thick VF Cap, new drag link, wafer, new gasket
BH705474	K	H or G	B	C	No motor capacitor, new counter, thick VF Cap, new drag link, wafer, new gasket
BJ705474	L	J	B	C	Modified mirror cover, new cable restrainer, no motor capacitor, new counter, thick VF Cap, new drag link, wafer, new gasket

2. DEFINITION OF BASIC CAMERA ASSEMBLY CONFIGURATIONS (CONT'D)

Configu-ration/ Part No.	Upper Camera Back	Lower Camera Back	Fresnel Assembly	Counter Assembly	Features
BK705467	M, AB or AC	H or G	C	C	Split image, with or without motor capacitor, non-modified mirror, old cable restrainer, new counter, new drag link, thick VF Cap, wafer, new gasket, concave mirror assembly, W/RTV or W/retainers, eyelens with or without 3° tilt
BL705467	K	G or F	B	C	New counter, new drag link, thick VF Cap, with motor capacitor, non-modified MC, old cable restrainer, with wafer, new gasket
BM705467	AA	G or H	C	C	Split image, concave mirror assembly with retainers, 3° tilt eyelens housing, with or without motor cap, non-modified mirror cover, old cable restrainer, new counter, new drag link, thick VF Cap, wafer, new gasket

3. DEFINITION OF SHUTTER CONFIGURATION FEATURES

Configu-ration/ Part No.	Stab Trim System	Positive Reset Trim System	8 Wire Cable 705805 PP7/8/9/10	"Kick up" Blades	Flat Tracking Blades	Sol No. 1/S4 Ph IIIA Dr, 8 Wire Cable Ph IA Elec.	Sol No. 1/S4 Phase IIIB 7 Wire Cable Ph II Elec.	Uninsulated Fairchild Phase I
G706276 G706385	X				X 10 Wire			
H706276 H706385	X		X		X			
J706276 J706385	X		X 10 Wire					
K706276 K706385	X		X	X				
L706276 L706385		X	X	X				
M706477		X	X	X				X
N706482		X				X		
P706472 P706478		X					X	

4. DEFINITION OF SOCKET ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	New Blade Socket 706424 and 706473	Features
A706367		Four solder connections
B706941		Three solder connections For Phase II electronics

5. DEFINITION OF REAR CASTING ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	New Standoff Design	New Casting 706444 for Ph. III Dr.	Features
A706275			
B706275			
C706275	X		Press in trim link standoff and cable retainer mounting changes
D706441		X	New casting for Phase III Drive System

6. DEFINITION OF CAM FOLLOWER ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	New Follow Hinge 706948-PP1	Features
A706280		
B706280		
C706946	X	Change hole in follow hinge for Phase III Drive System

7. DEFINITION OF LENS ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Crimped Assembly	Features
A701202		
B701202	X	Crimped assembly rather than epoxy cement

8. DEFINITIONS OF UPPER CAMERA BACK CONFIGURATIONS

Configuration/ Part No.	Aspherical No. 1 Lens	Boot Assembly Configuration	Wafer Added	Cubic and Toroid Eyelens	Lens Gasket 705894	VF Cap 705542	Mirror Cover 705547	Eyelens Assembly Configuration	Concave Mirror Configuration	Features
A705823										
C705823	X	B								
D705823	X	C								
E705823	X	D								
F705823	X	E								
G705823	X	F								Single insert molded boot, no wafer, old gasket
H705823		G	X	X				E	C	Double insert molded boot, old gasket, wafer added, thin VF Cap, old mirror cover
J705464		G	X	X	X			E	C	New gasket or no gasket, wafer added, thin VF Cap, old mirror cover
K705468		G	X	X	X	X		E	C	Thick, VF Cap, new gasket or no gasket, wafer added, old mirror cover
L (Later)		G	X	X	X	X	X	E	C	Modified mirror cover, thick VF Cap, new gasket, wafer added

8. DEFINITIONS OF UPPER CAMERA BACK CONFIGURATIONS (CONT'D)

Configuration	Boot Assembly Config.	Wafer Added	Lens Gasket 705894	VF Cap 705542	Mirror Cover 705547	Eyelens Assembly Config.	Concave Mirror Config.	Features
M705613 PP1	G	X	X	X		E (Version IV Lens)	E (RTV)	Non 3° tilt eyelens HSG, concave mirror w/RTV, thick VF Cap, new gasket, wafer added
AA705613 PP2	G	X	X	X		F (3° tilt)	D (retainers)	3° tilt eyelens HSG, concave mirror w/retainers, thick VF Cap, new gasket, wafer added
AB705613 PP1	G	X	X	X		E (Non 3° tilt)	D (retainers)	Concave mirror w/retainers, non 3° tilt eyelens housing, thick VF Cap, new gasket, wafer
AC705613 PP1	G	X	X	X		F (3° tilt)	E (RTV)	3° tilt eyelens housing concave mirror w/RTV, thick VF Cap, new gasket, wafer

9. DEFINITION OF FRESNEL ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Split Image	Drag Link 705897
A705413		
B705447		X
C705458	X	X

10. DEFINITIONS OF COUNTER CONFIGURATIONS

Configuration/ Part No.	Oval ○	Square □	Erlichman Counter
A705403	X		
B705403		X	
C705863		X	X

11. DEFINITION OF SOL NO. 1/S4 ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Phase II Drive System	Phase II HI Volume	Phase III Drive System	Long Flex	Short Flex
A706427					
B706427					
C706427	X				
D706427		X			
E706460			X	X	
F706465			X		X

12. DEFINITION OF CONCAVE MIRROR ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Anti-B1 Stable	With Retainers	With RTV
A705292			
B705292			
C705292	X		
D705609		X	
E705930			X

13. DEFINITION OF EYELENS ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Version IV Eyelens	Version IV Housing
A705293		
B705293		
C705293		
D705293		
E705396	X	
F705610		X

14. DEFINITIONS OF LOWER CAMERA BACK CONFIGURATIONS

Configuration/ Part No.	S-6 Switch Slanted 705271-PP6	Bottom Pl. Configuration	Bowed Inner Frame 705517-100-7	Omit Safety Latch	PP-6 Bottom Plate	Omit Baffle	Omit Motor Capacitor	Cable Restrainer 705910
A705379		D						
B705379	X	B/D or G						
C705379	X	H						
D705379	X	H	X					
E705379	X	Not marked	X		X			
F705451	X	Not marked	X	X	X			
G705477		Not marked	X	X	X	X		
H705473		Not marked	X	X	X	X	X	
J705473		Not marked	X	X	X	X	X	X

15. DEFINITION OF BOOT ASSEMBLY CONFIGURATIONS

Configuration/ Part No.	Canfield Boot BP-7	Dapro Boot CP-7	Canpro Boot DP-7	Moxness Boot EP-7	IF Insert Molded Boot (Single)	IF and Shutter Insert Molded Boot PP-1	Round Hole IF and Shutter Insert Molded Boot PP-2
B705356	X						
C705356		X					
D705356			X				
E705356				X			
F705436					X		
G705530							X
H705530						X	

When the release button is pressed, a switch S1 closes (Figure 1-11 A and B) and activates an electronic latch which, in turn, applies operating power to the shutter. As soon as power is applied to the shutter, solenoid no. 1 is energized and rapidly moves the shutter blades to the closed position. Light entering the lens is now cut off and the reflex mirror is swung upward to picture-taking position. The electronic latch assures that the sequence will be completed even if the operator removes his finger from the exposure button, S1.

When the mirror swings up, a mechanically operated switch (S3) actuates a "Y" delay circuit (40 milliseconds) (Figure 1-12) so that the shutter will not function until mirror bounce has subsided. At the end of the delay period the electronic circuitry removes the power from the solenoid and the opening spring sets the shutter blades in motion toward the full open position. At the same instant an electronic switch opens and starts the integration cycle. The integration cycle is that period during which the total amount of light (intensity and duration)

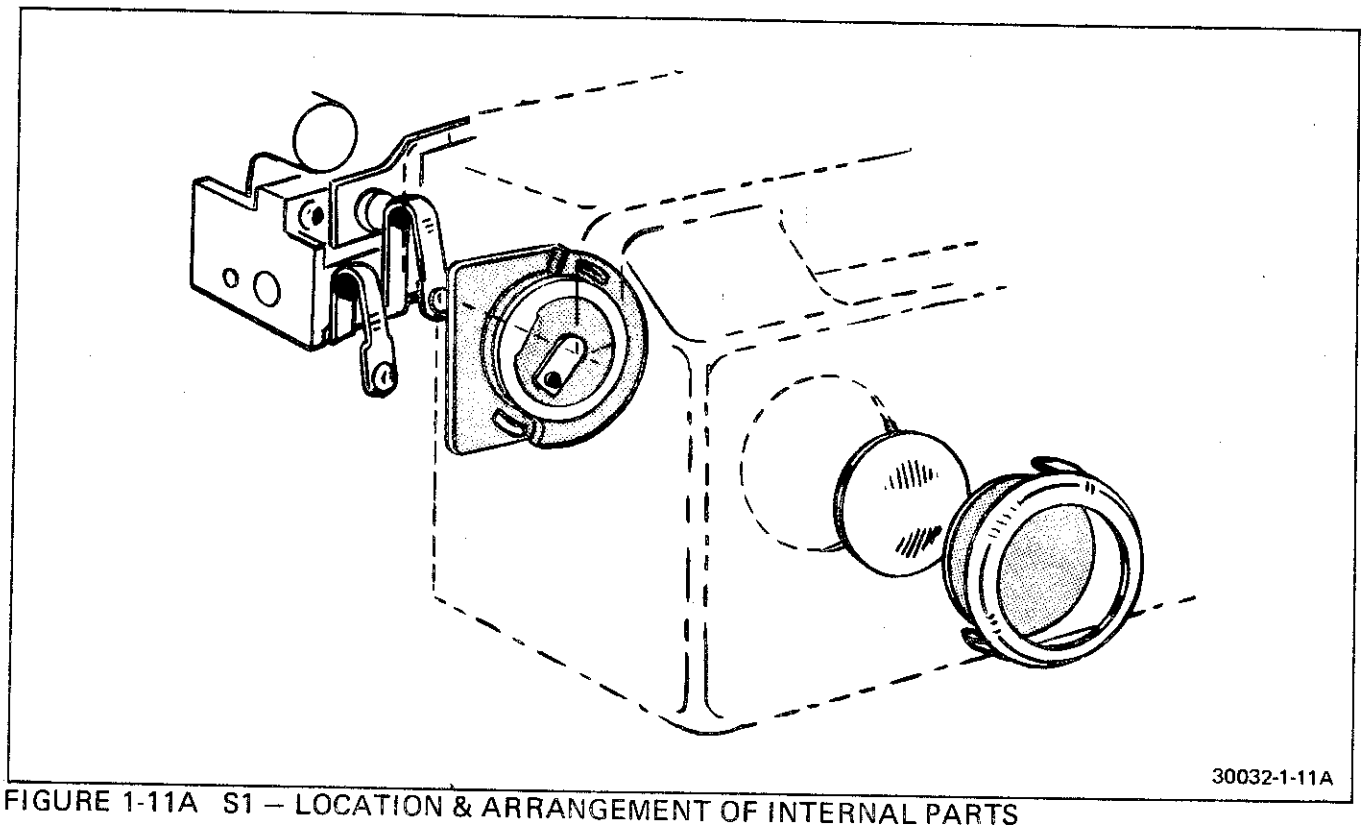


FIGURE 1-11A S1 – LOCATION & ARRANGEMENT OF INTERNAL PARTS

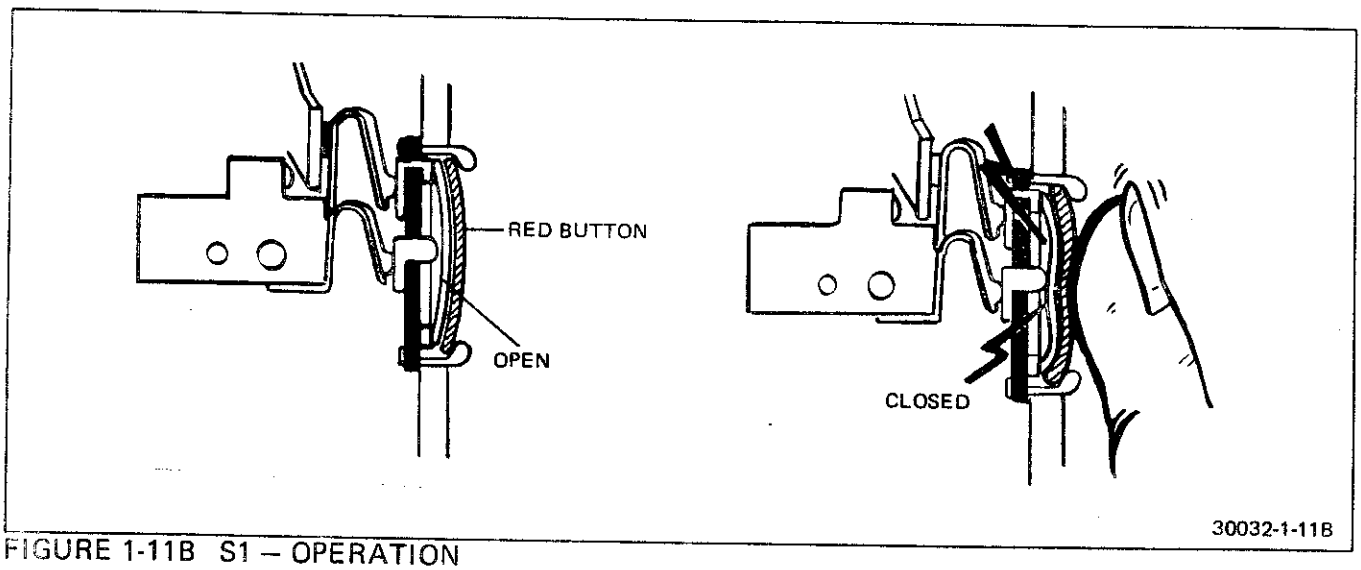


FIGURE 1-11B S1 – OPERATION

16. DEFINITION OF BOTTOM PLATE ASSEMBLY CONFIGURATION FEATURES

Configuration	Long Pinion Shaft Slot	Lubricated 1st Reduction Gear	Cable Restrainer Modification	Slanted Switches	Lubricated Ram Slot	Pick Latch 100-2 Pick Latch Spring PP-8	Adjusted S-5	Gaged S7's	Notch for Dynamic Lite Seal	Gaged Bell Crank	Insulated Motor Coupling	Flush Contact Block Tenon	Erecting Link Fix	PP-5 Bottom Plate
A														
B	X		X		X									
C	X	X	X	X	X									
**B/D	X	X	X	–	X	X	X	X	X	X	X	X	X	
*D	Partial	X	Partial		X	X	X	X	X	X	X	X	X	
E	Not	Used												
F	X	X	X	X	X	X	X	X	X	X	X	X		
***G	X	X	X	X	X	X	X	X	X	X	X	X	X	
H	X	X	X	X	X	X	X	X	X	X	X	X	X	X

*Configuration "D" Assemblies may be obtained by reworking Configuration "A" Assemblies.

**Configuration B/D Assemblies may be obtained by reworking Configuration "B" Assemblies.

***Configuration "G" Assemblies may be obtained by reworking Configuration "C" or from Timex new production tooling.

17. DEFINITION OF FRONT COVER CONFIGURATIONS

Configuration/ Part No.	Short Cam 705372 PP-3	Reshaped Cam 705386 PP-1	Strong L.S. Spring	Biased Spread System	Mod. Red Frame Groove	Press. Sens Leather 705189 PP5/PP6	Step Top Roll	Light Seal Left	Thick Front Cover
A705845	X			X					
B705845	X		X	X	X	X			
BM705845	X		X	X	X	X	X	X	
C705439		X	X	X	X	X	X	X	
D705539		X	X	X	X	X	X	X	X

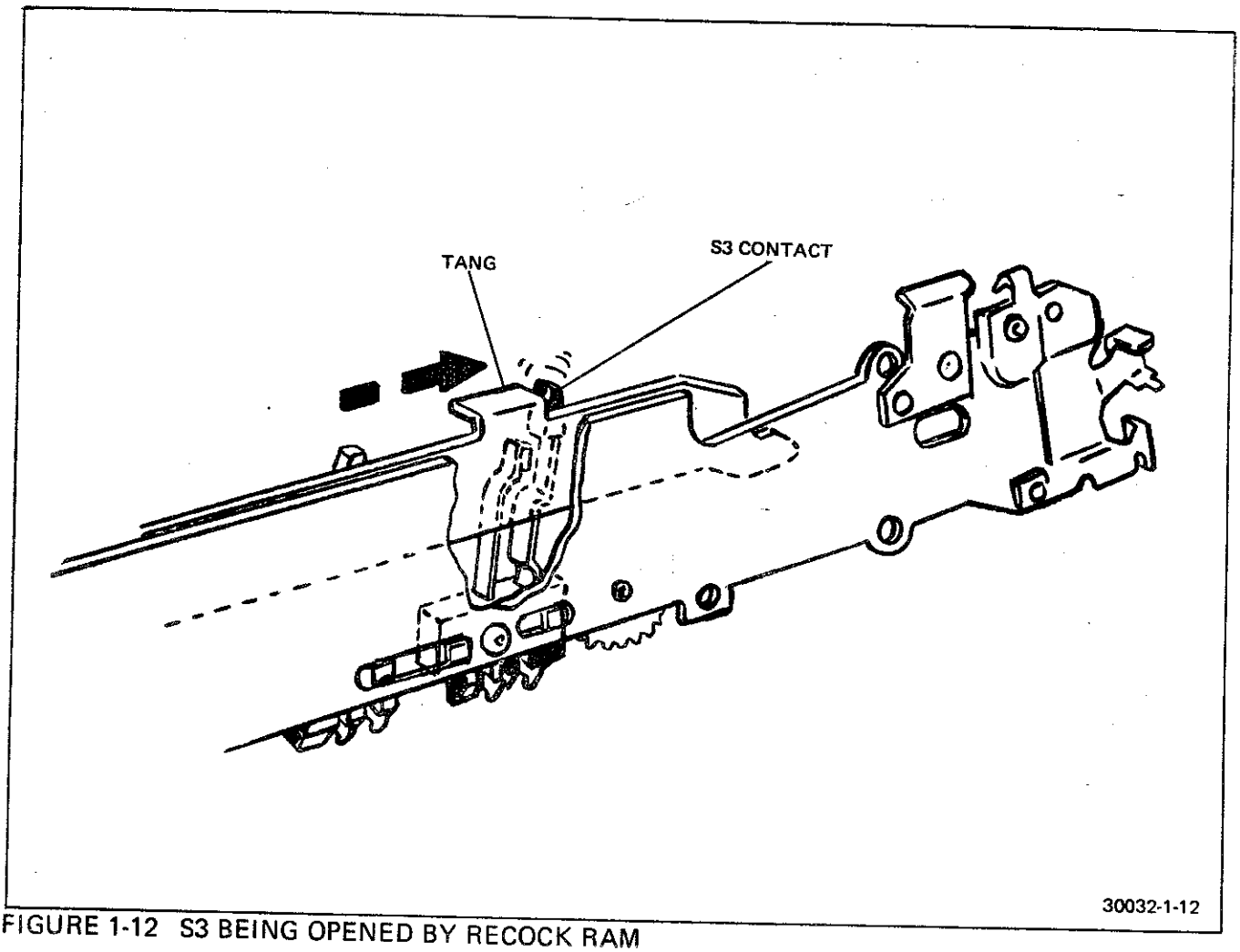


FIGURE 1-12 S3 BEING OPENED BY RECOCK RAM

reaching the photocell is transformed electronically into the length of time the film is being exposed. The shape of the openings in the shutter blades and the motion of the blades is such that all of the factors involved are continuously variable throughout the exposure period. This fact, however, is a design consideration and should not confuse the theory of shutter operation from a maintenance point of view.

When commanded by the timing (integration) circuitry, the solenoid is actuated to close the shutter despite the size of the aperture. When the solenoid has reached the end of its stroke (shutter closed), it no longer requires maximum current to hold it at that position. An electronic circuit called the POWER DOWN CIRCUIT supplies power at an adequate current level to hold the solenoid after the high-current circuit has completed the solenoid operating function. Thus, the shutter will remain closed, with minimum battery drain.

When the camera completes all of its automated functions and the release button has been released, all voltage is removed from the solenoid and the shutter opens in preparation for the next exposure.

It should be noted that under extremely low light conditions, the shutter will close in approximately twenty seconds whether a suitable exposure has been produced or not.

D. SHUTTER DESCRIPTION (FLASH MODE)

The special ten-shot flash bar is equipped with a shorting bar so that when the bar is inserted, two contacts within the camera are shorted. This arrangement is identified as S2. When S2 is closed, it notifies the shutter electronic circuit that a bar is in place and ready for firing. In general, the sequence of functions remains the same as for ambient light operation with the following exceptions:

A device identified as the interceptor link is connected to the lens focusing mechanism (Figure 1-13A). This link is moved as the lens is focused regardless of whether ambient-light or flash pictures are being taken. When a bar is in place (S2 closed) and the gear train opens switch S5 (Figure 1-14), solenoid no. 2 is energized and pulls the interceptor link into position to physically restrict the shutter blade travel (Figure 1-13B). Since the interceptor link is controlled by the focusing mechanism, the shutter opening is related to camera-to-subject distance thus compensating for the flash-bulb-to-subject distance. Since the photocell aperature is a part of the shutter blades, the amount of reflected light reaching the cell will also be a function of focusing distance. The shutter electronics include a delay circuit which delays firing of the flash lamp until the shutter has opened to the point established by the ambient light reaching the cell. During this delay period, if the ambient light level is sufficiently high to cause triggering of the integrating circuits, the exposure will be made and the shutter closed before the firing voltage reaches the lamp and the lamp will not be fired.

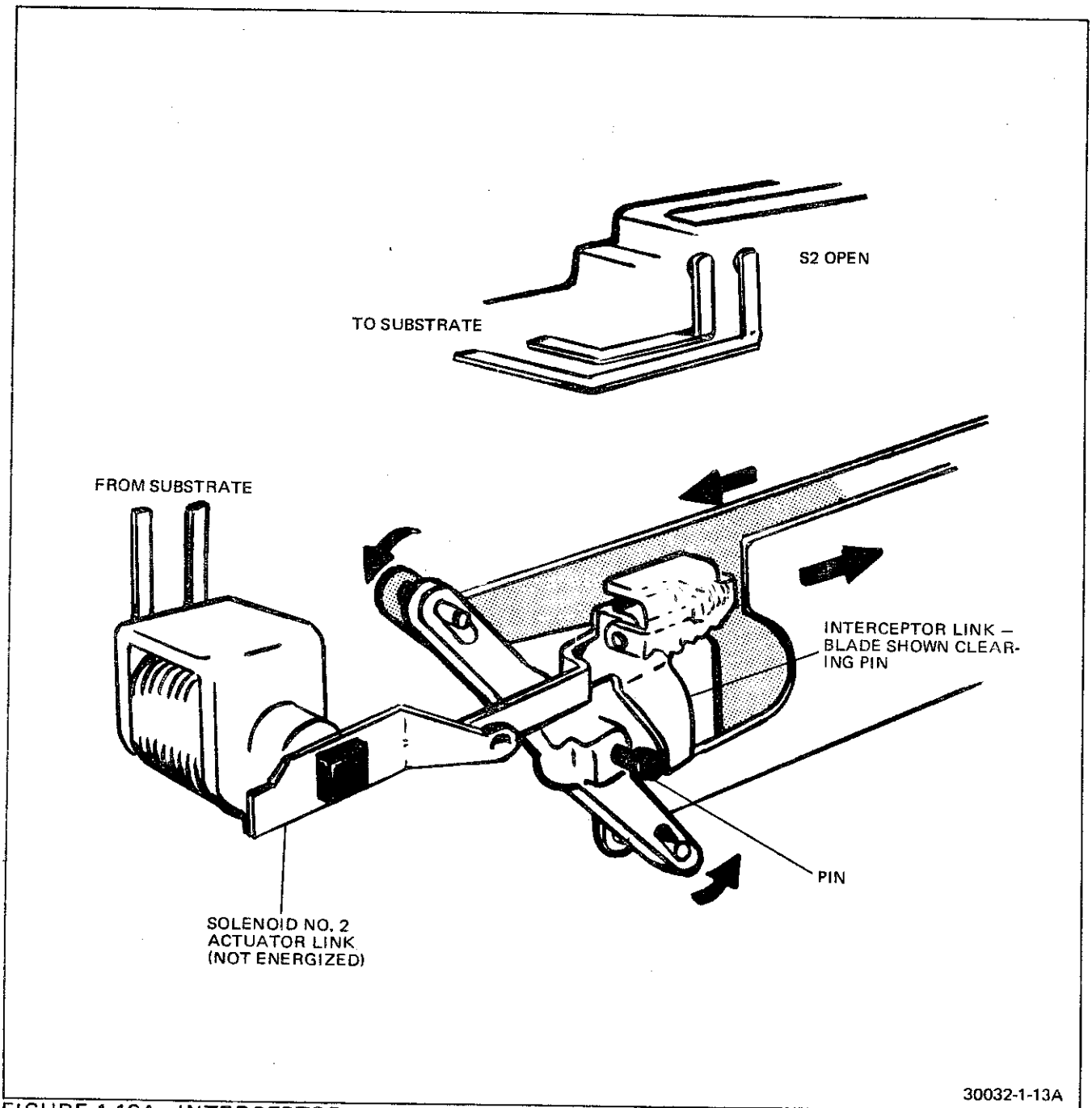


FIGURE 1-13A INTERCEPTOR LINK, SOLENOID 2, S2 OPERATION – SOLENOID DEENERGIZED

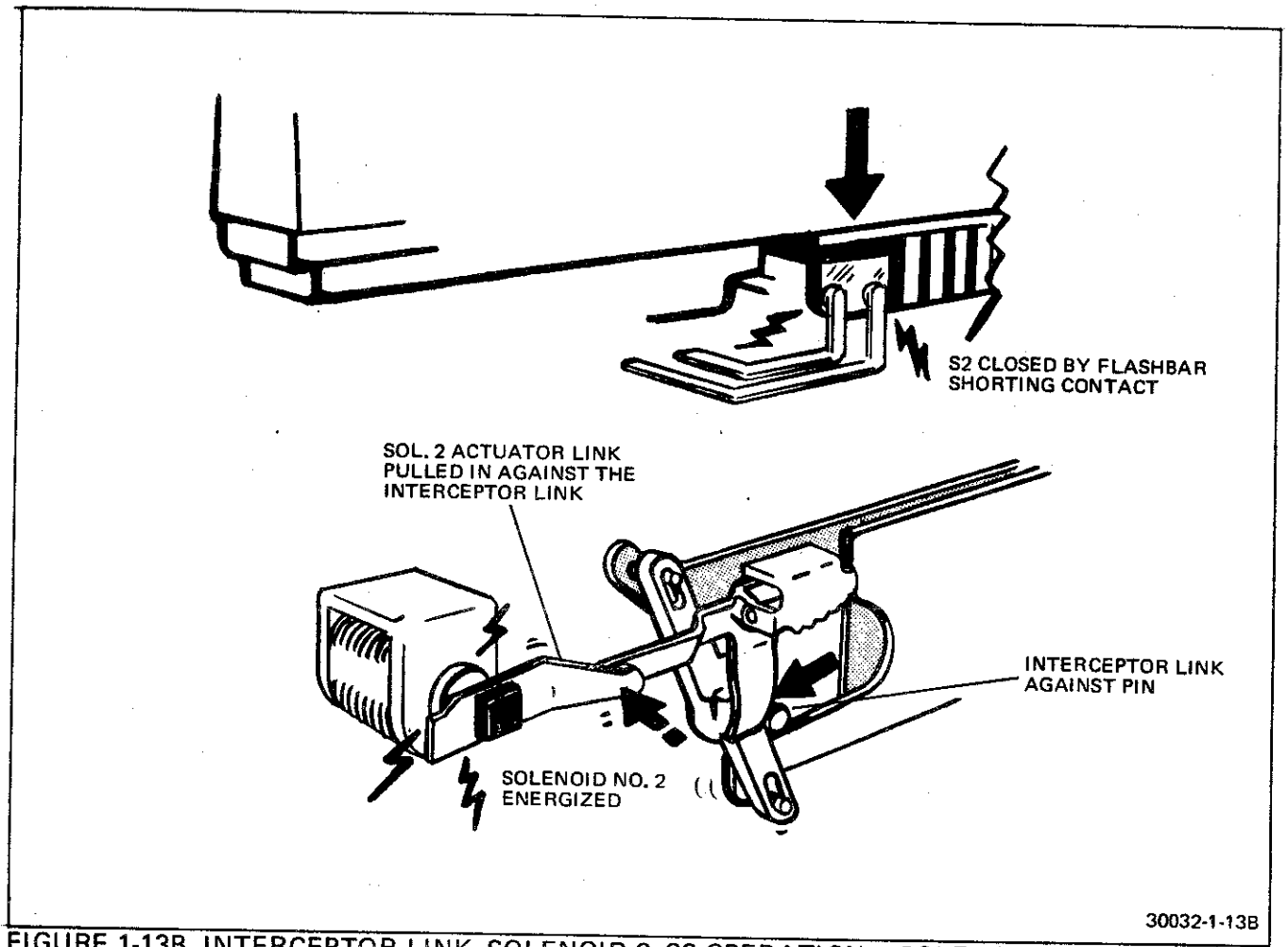


FIGURE 1-13B INTERCEPTOR LINK, SOLENOID 2, S2 OPERATION – SOLENOID ENERGIZED

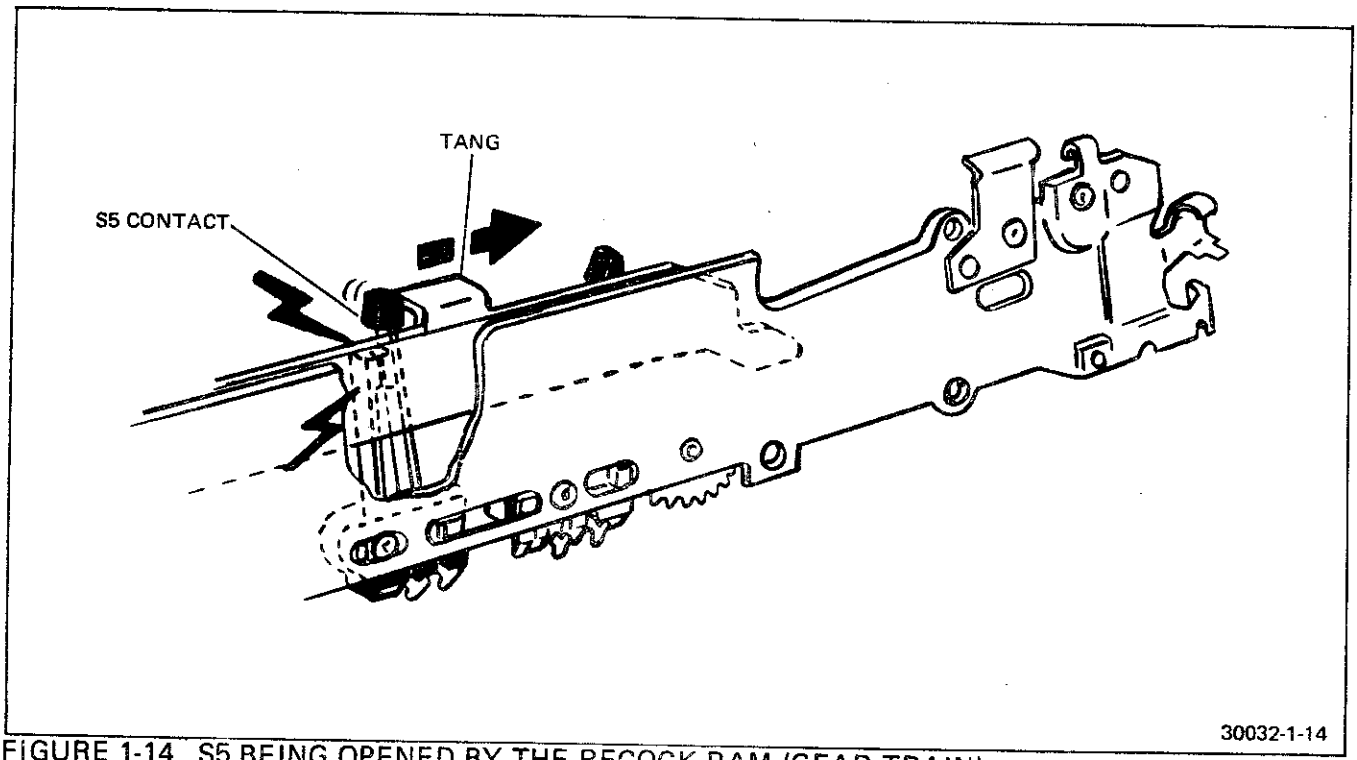


FIGURE 1-14 S5 BEING OPENED BY THE RECOCK RAM (GEAR TRAIN)

If the flash delay period reaches completion without triggering the shutter, the circuitry removes the holding current from solenoid no. 2. Since the solenoid is an electro-magnetic device, removing power causes a collapsing magnetic field which induces a flyback voltage. This pulse is fed to the flash circuitry which, in turn, applies the firing voltage to the flash lamp.

The flash circuit just mentioned performs two additional functions. It produces a signal that shorts out the integrating (exposure timing) capacitor and thus discharges the capacitor so that it can repeat the integrating function. The same signal also initiates the flash time-out interval. At the end of the flash timing interval, the circuit energizes solenoid no. 1, the shutter closes, and the sequence proceeds as in the ambient-light mode.

If there are no unused flash lamps remaining in the array when the operator attempts to make a flash exposure, all of the previously described circuitry will function up to the actual firing of the flash lamp. Since there is no lamp to ignite, no flash firing current will be drawn. This being the case, there will be no output signals from the flash sequencing circuit, and an ambient light exposure will be made. If there is adequate ambient light to produce a correctly exposed picture in less than twenty seconds, such a picture will result. The operator will be notified by the lack of a burst of light from the flash.

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II - THEORY OF OPERATION

A. INTRODUCTION

A general description of the camera and the sequence of its functions is contained in Section I. In that section, detailed analysis of individual assemblies and electrical circuits was minimized so that emphasis could be placed on the interrelationship of various functions. In the following paragraphs, the individual groups of components are described in greater detail. The descriptions are presented in the sequence in which the components were mentioned in Section I.

B. POWER SOURCE

Power for the drive motor, the shutter electronics, and the flash array is supplied by a specially designed six-volt battery incorporated in each ten-exposure film pack. When the pack is inserted into the camera, two contact pads on the rear surface of the pack engage two spring-loaded contacts on the inner bottom surface of the camera bottom plate. From these two points, it is distributed to its destinations by the copper foil strips of a flex circuit on the outer surface of the bottom plate.

The battery has adequate capacity to expose all ten films with six to twelve months expected shelf life. The camera with a partially exposed film pack can be put aside for up to one year and still retain sufficient capacity to complete the film pack.

C. LENS

The lens employed is a four element, glass lens of f/8 aperture with a focal length of 115mm. It has a focusing range of infinity down to 10.4 inches. Focusing is accomplished by movement of the front element only. Helical threads in the lens mount provide the linear lens element movement. Operation is by means of a geared wheel at the top of the shutter housing. There is no manually adjustable diaphragm associated with the SX-70 lens.

D. VIEWING AND EXPOSING SYSTEM

When the camera is erected to picture-taking configuration, the subject can be viewed through the collapsible viewfinder. Figures 2-1 and 2-2 show the two optical paths in the camera. Note the

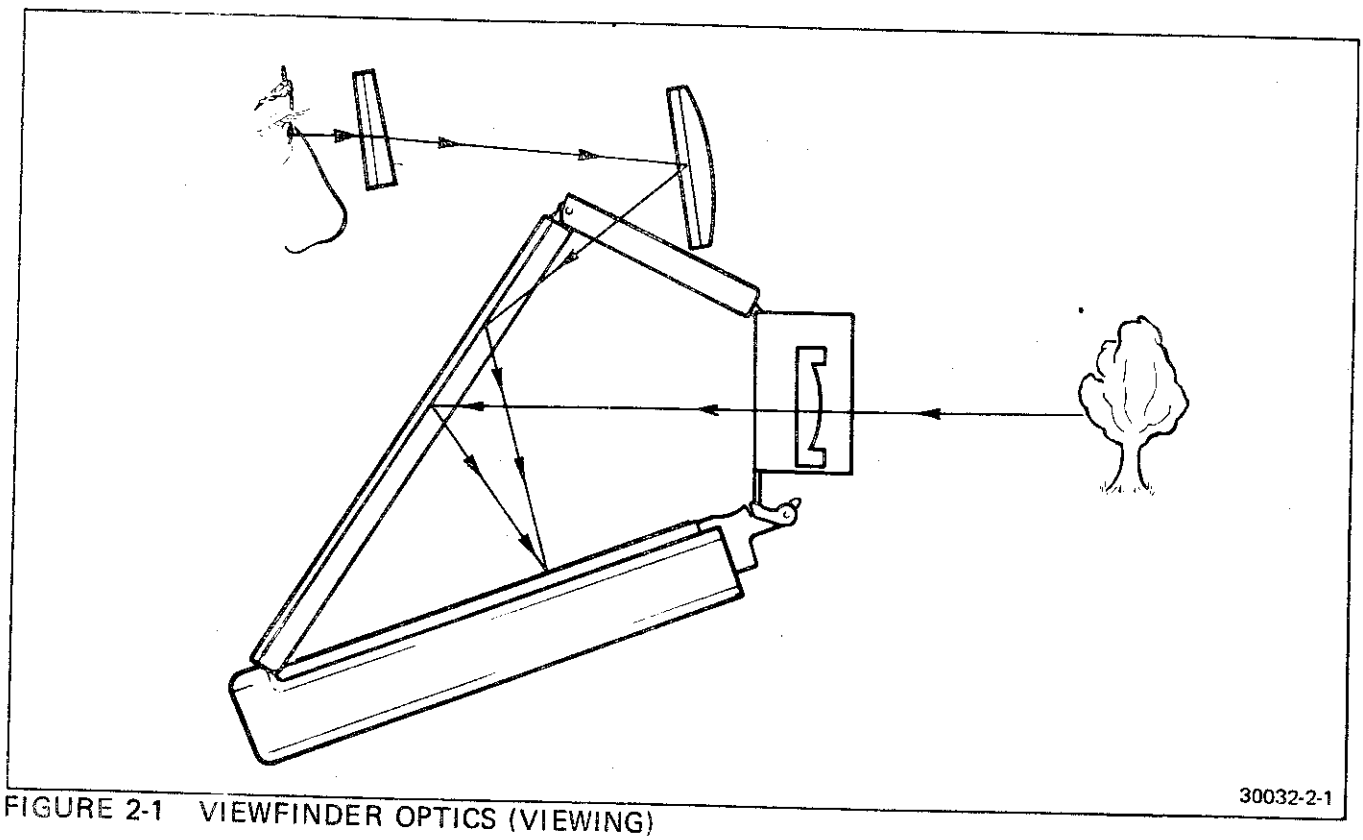


FIGURE 2-1 VIEWFINDER OPTICS (VIEWING)

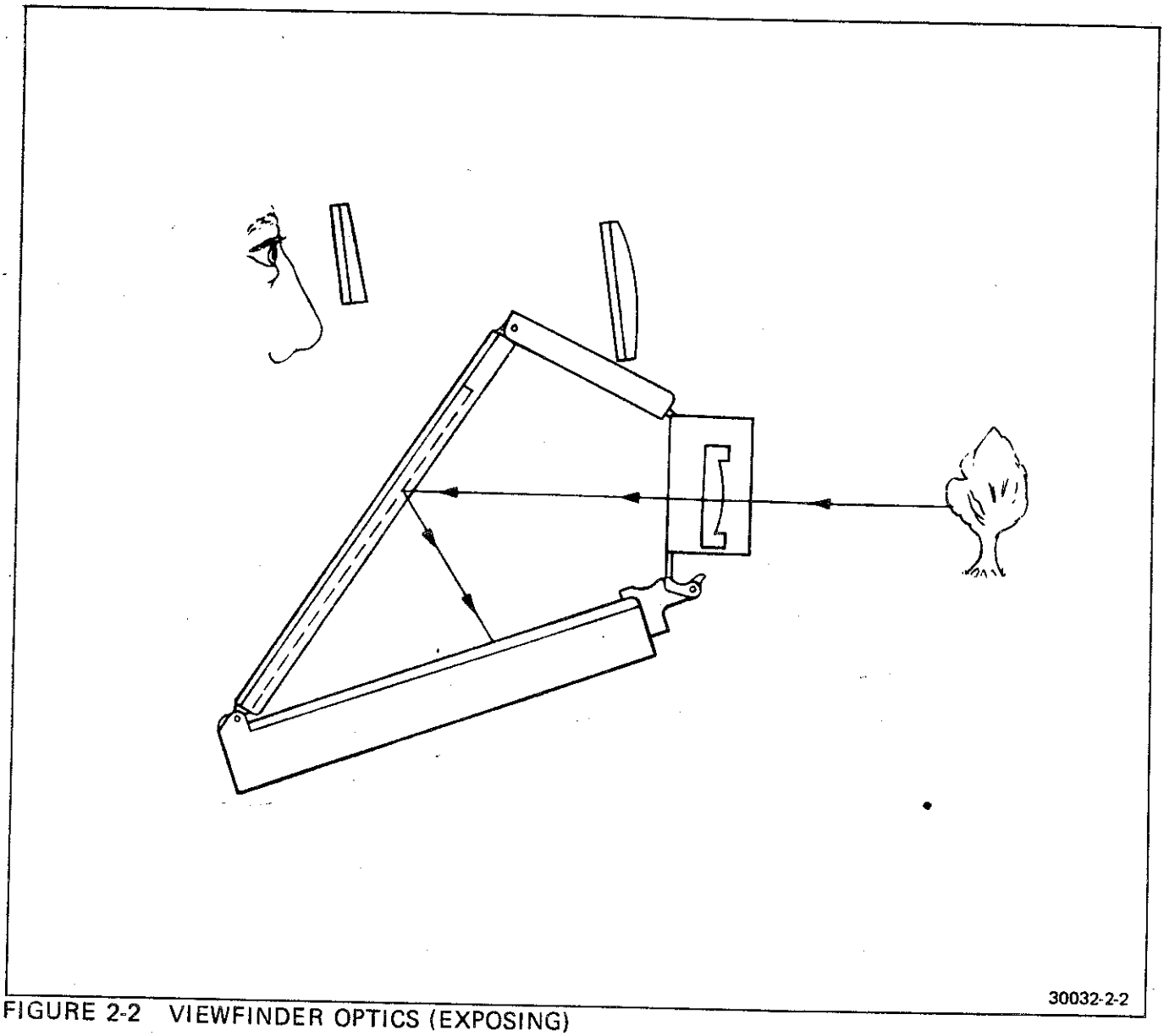


FIGURE 2-2 VIEWFINDER OPTICS (EXPOSING)

direction of the arrows. Reflected light from the subject passes through the camera lens and is reflected by the viewing mirror (on the inside surface of the mirror cover) to the Fresnel viewing screen described in detail in a following paragraph.

The entire image of the subject is now reproduced on the viewing screen. In order to see the image, the viewfinder optics are required. The image must appear sharp to the eye to permit proper focusing, and the path must be diverted through the camera from the viewing screen to the eye. The first requirement is satisfied by the eye lens and the parabolic mirror. The parabolic mirror and the viewing mirror satisfy the second requirement.

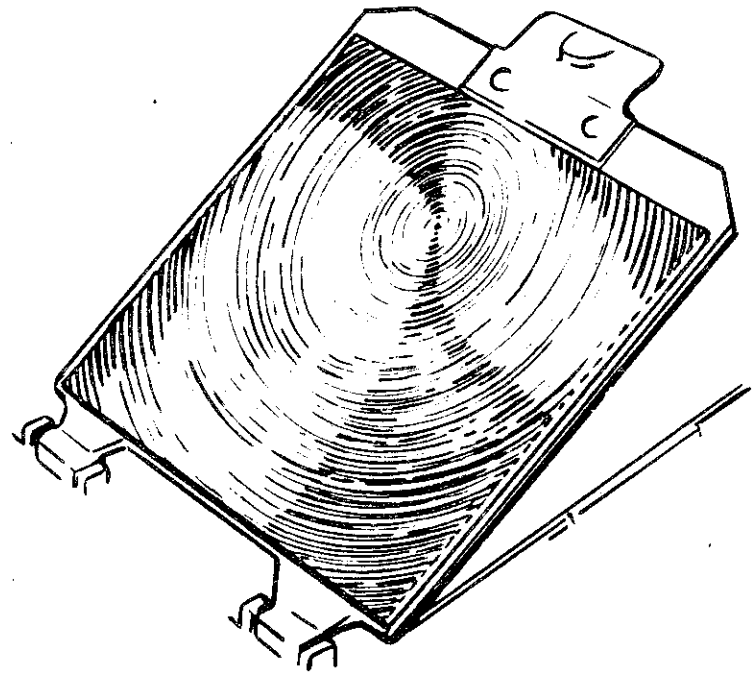
1. Fresnel

The special Fresnel (pronounced *Freh-nell*) screen is employed to enhance the viewing image by increasing the brightness and definition. If a matte white surface were substituted for the Fresnel screen, an image would still be visible. However, the light rays striking nearest the corners of the screen meet the screen at a more oblique angle than the rays striking near the center. At this greater angle, a larger percentage of the light is dispersed and less light is returned to the viewer. Thus, on a matte-screen image the corners appear darker than the center. The Fresnel screen is designed to overcome this problem.

The screen itself is a sheet of plastic upon which are impressed a series of concentric rings much like the grooves pressed into a phonograph record (Figure 2-3) instead of having a vee shape; however, the grooves in the Fresnel *(pronounced FREH-NELL)* screen form a saw-tooth with a tooth angle increasing slightly with each successive groove in such a manner as to complement the decreasing angle of the light ray. The saw-tooth flattens out completely at the exact optical center of the screen. In the SX-70 camera, the optical center is not the geometrical center of the screen.

The surface of the screen is silvered to provide optimum reflectance. The result is a brilliant viewing image evenly illuminated from corner to corner.

For the reader who is familar with the use of a Fresnel lens used in conjunction with a ground-glass focusing screen, or a Fresnel-ground focusing magnifier, it must be noted that these are transmission devices while the Polaroid screen is a reflecting medium. Otherwise, the brilliance-enhancing properties are the same. A suitable analogy would be the comparison of a lenticular projection screen compared with a matte surface. The ribbed surface of the lenticular screen narrows the angle of reflectance but increases the brilliance of the image within the viewing area.



OVERALL VIEW

FRESNEL GROOVES – SIDE VIEW ENLARGED

30032-2-3

FIGURE 2-3 FRESNEL SCREEN

2. Viewfinder

The aforementioned viewfinder optics consist of an eye lens and a concave mirror. As in all simple optical systems, a certain amount of distortion is inherent in this design. A small rectangular mask called the stigmatic pupil is introduced into the viewfinder optical path to limit the angle of acceptance and, thus, reduce distortion. The size of the pupil opening is large enough to provide acceptable viewing brilliance and, at the same time, small enough to be easily closed when the camera is in the exposure mode. On newer models, a small wafer lens replaces the stigmatic pupil (Figure 2-4).

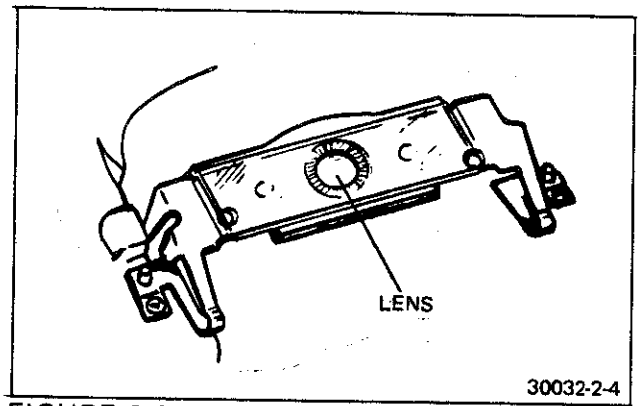


FIGURE 2-4 WAFER LENS ASSEMBLY

Ignoring the shutter functions momentarily, when the operator presses the exposure button, the Fresnel carrier swings away from the film plane and comes to rest in front of the viewing mirror. During the movement of the Fresnel carrier (and until it returns to its initial viewing position), a flexible light stop closes the path between the viewfinder and the inner camera to prevent light through the eye lens from reaching the film. The movement of the spring-driven Fresnel carrier is accomplished by the mirror release cam which is a component of the motor-driven gear train. The details of the automated action are described in the discussion of the electro/mechanical assemblies.

E. CAMERA ELECTRONICS

1. Integrated Circuits

The SX-70 is unique, both in its principles of operation, as well as its functional design. It can be considered an electronically-controlled mechanical device. A single circuit board (substrate) contains all of the electronic components with the exception of the motor control (MCC) integrated circuit and flash circuit. Because the board is mounted inside the shutter housing, it becomes identified as a part of the shutter (see Figure 2-5). It must be noted, however, that all of the camera automation is controlled by these integrated circuits.

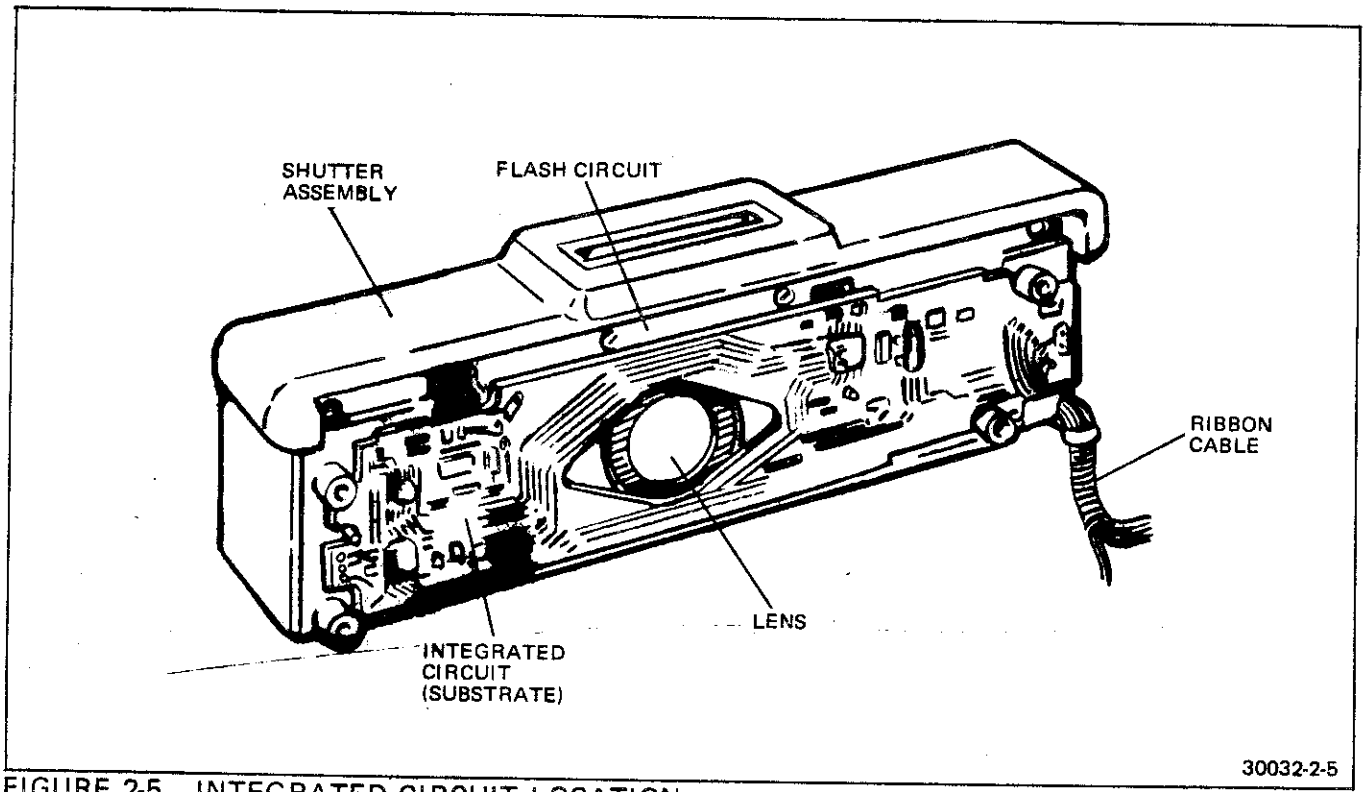


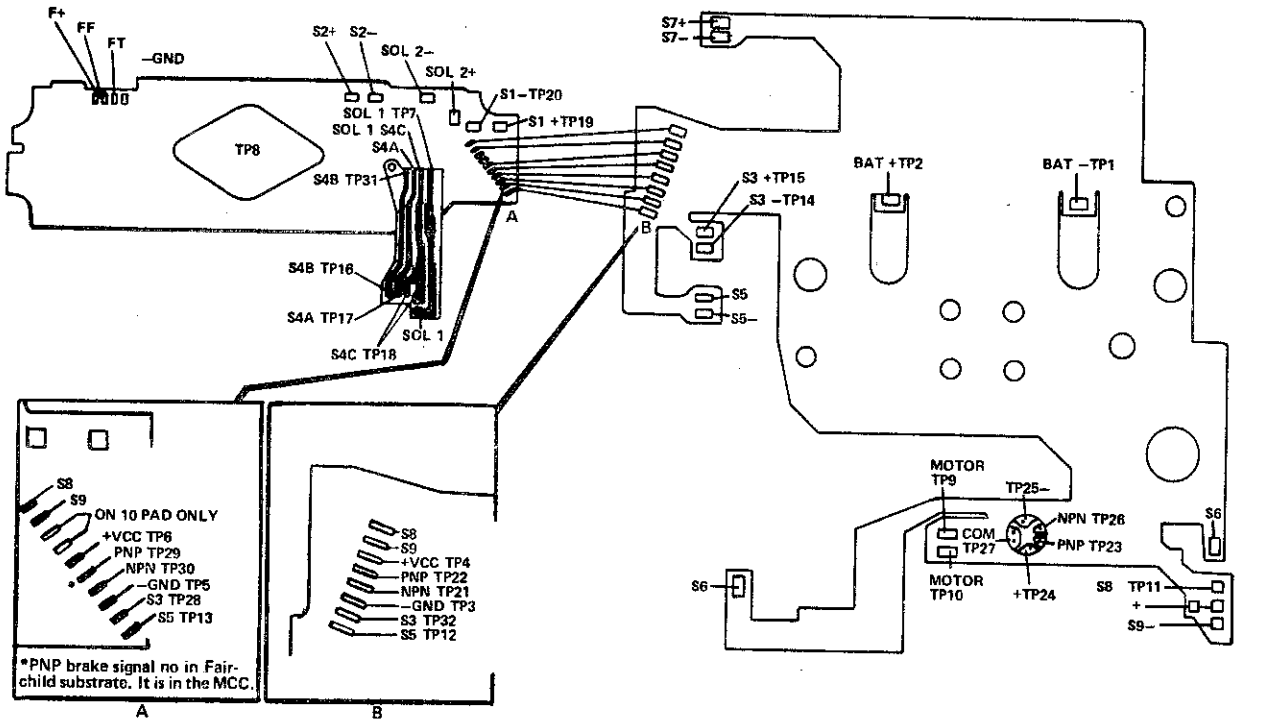
FIGURE 2-5 INTEGRATED CIRCUIT LOCATION

The integrated circuits are not repairable items and, for that reason, the theory of operation presented in this manual is limited to those functions which can be evaluated by the test equipment and for which an understanding of the theory will assist in analyzing malfunctions.

2. Integrated Circuit Test Points (Figure 2-6)

a. Switch S1 is actuated by either the red exposure button or a remote control cable release. It is operated by the photographer and it causes the camera to run through a complete exposure/film delivery cycle.

b. Switch S2 places the circuitry into the flash mode. Switch S2 is closed when the flash array is inserted into the connector on top of the shutter housing. It commands the integrated circuit to select an unused flashbulb and, to fire the bulb. It also instructs the circuit to limit the travel of the shutter blades so that exposure will be determined by flash-to-subject distance. This is accomplished by energizing solenoid no. 2 which, in turn, engages a mechanical coupling between the shutter and the focusing mechanism.



30032-2-6

FIGURE 2-6 INTEGRATED CIRCUIT TEST POINTS

c. Switch S3, normally closed, is opened by the recock ram located in the gear train assembly. See Figure 2-7. As the exposure sequence begins, S3 actuates by opening a delay circuit in the integrated circuit which retards the start of the actual exposure approximately forty milliseconds so that mirror bounce will have subsided before a picture is taken. At the end of the delay time, the shutter starts to open and the electronic timing function (integration) takes place. If a flash array is in place, S2 has so informed the circuit and the flash delay circuits will be enabled. At the end of the exposure cycle when the Fresnel carrier moves down into viewing position, S3 closes as the recock ram moves away.

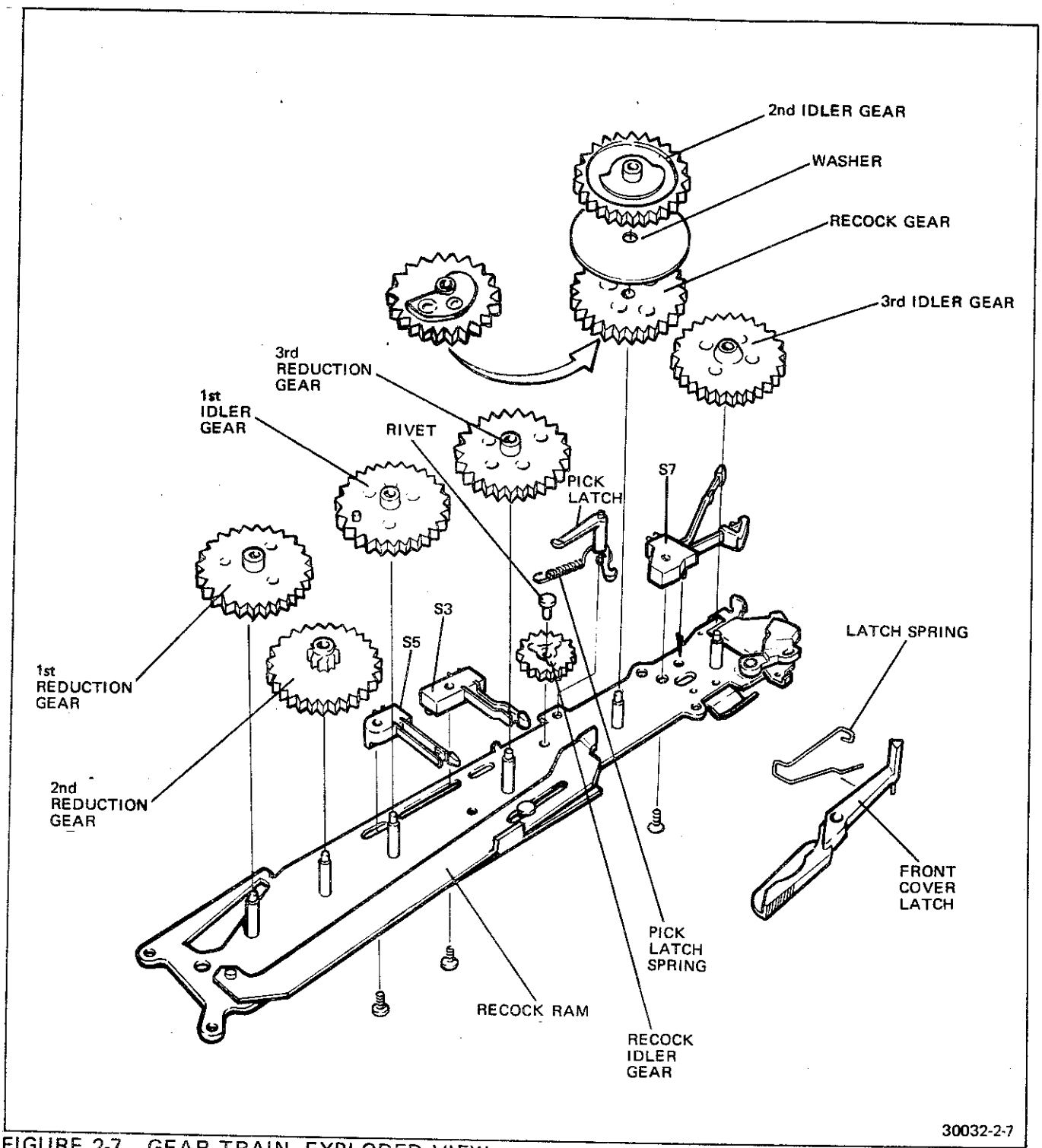


FIGURE 2-7 GEAR TRAIN, EXPLODED VIEW

d. Switch S4 is actuated by a pin on the plunger of solenoid no. 1, the shutter blade actuating solenoid (Figure 2-8).

NOTE: Whenever the SX-70 shutter is discussed, it must be noted that, since the camera is a single-lens reflex and focusing is accomplished through the taking lens, the shutter's initial state is open, not closed as in other Polaroid cameras.

When the shutter integrated circuit initiates an exposure, full battery power is applied to solenoid no. 1 to close the shutter. Once the solenoid plunger is in motion, it no longer requires as much power as was needed to overcome its static inertia. Switch S4, therefore, opens S4 contacts to the integrated circuit and the electrical power to the solenoid coil is reduced to the "power-down" value which is sufficient to complete the exposure cycle but low enough to conserve battery drain.

Simultaneously, switch S4 connects (CB made) the integrated circuit to power the drive motor to operate the gear train. When S4 is actuated, it also disconnects power from the integrated flash circuitry. This action prevents damage to the circuit in the event that a flashbulb becomes short-circuited after it is fired.

e. Switch S5 (normally closed), like S3, is located in the gear train and actuated by the recock ram. When the gear train rotates to the appropriate point in its cycle, S5 opens and removes power from the drive motor, applying dynamic braking voltage to stop the gear train quickly. The integrated circuit reacts to this command in such a way that the exposure cycle will continue to its completion even though the operator has released the exposure button (S1). After exposure and when the Fresnel carrier returns to the viewing position, S5 is closed by the recock ram and stops the camera cycle.

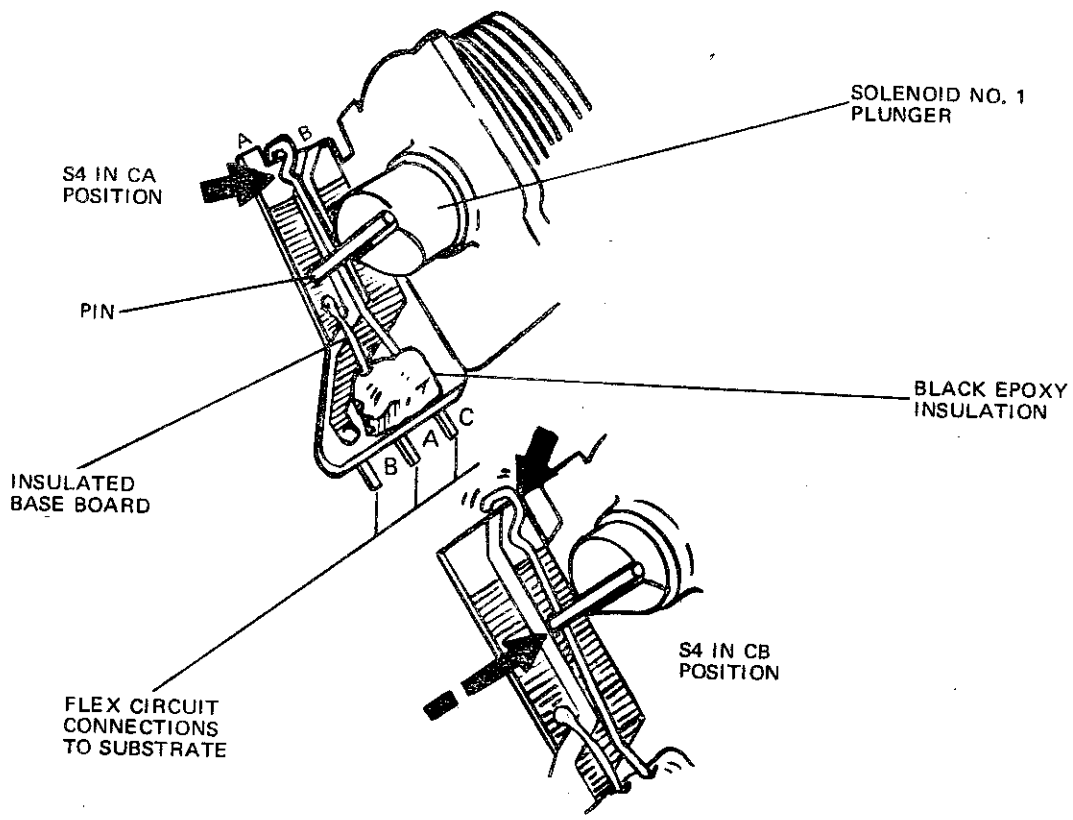


FIGURE 2-8 S4 SWITCH OPERATING CONFIGURATIONS

f. Switch S6 is closed by the opening of the camera to picture-taking configuration. It disconnects the negative side of the battery from the common return (ground) when the camera is folded to assure the removal of power from the circuit.

g. Switch S7 is closed when the front cover is closed. It is wired in series with S6. Like S6, S7 disconnects the negative side of the battery from the common return so that the camera cannot function until the front cover is closed and latched.

h. Switch S8 is a part of the exposure counter assembly operated by the counter wheel. Inserting the film pack closes S8 providing dark slide eject power. After slide ejection, counter-wheel opens S8. S8 then remains open until the next cycle begins.

i. Switch S9 is near S8 on the exposure counter assembly. When the counter reaches the 0 position, switch S9 closes and the integrated circuit inhibits the flash-firing function, so that if an active bulb is still installed, it will not be wasted.

j. For a handy summary, see the Switch Function Table.

3. Functional Sequence

The following paragraphs describe the sequence in which the switches operate during normal operation of the camera.

a. The operator opens the camera. Switch S6 connects the battery into the camera circuitry.

b. The operator opens the front cover. Switch S7 opens and removes battery power from the camera.

c. The operator inserts a film pack. When the used film pack was removed a mechanical coupling device set the exposure counter to the position just before the first exposure and so closed S8, but since S7 has removed all battery power no action occurs.

d. The operator closes and latches the front cover. S7 closes, power is applied and the camera ejects the dark slide.

NOTE: During this action (and in certain other operations) other switches actuate and functions occur but, unless they contribute to the particular camera function being described, they are omitted from this discussion.

The counter indicates exposure no. 10, closes S8, thereby showing that the camera is ready to take the first picture.

e. The operator aims, focuses the lens, and presses the exposure button (S1). The integrated circuit actuates solenoid no. 1 which closes the shutter blades. Solenoid 1 opens switch S4 contacts CA which in turn, switches the circuit from full solenoid power to holding current (power-down). Closing contacts CB of switch S4 simultaneously starts the drive motor and removes power from the flash circuits.

f. As the gear train runs, it mechanically releases the spring-loaded Fresnel carrier so that it leaves the film plane and rises to its exposure position. This is accomplished by the mirror release cam of the second idler gear. Immediately following the mirror release, the recock ram falls off the recock cam allowing the ram to snap forward. The ram moves away from S5 allowing S5 to open. This action causes the integrated circuit to stop and dynamically brake the motor which will remain at rest throughout the exposure segment of the cycle. The S5 switch action also programs the circuit to complete the cycle even though the operator has released the exposure button.

NOTE: There would appear to be a contradiction between this step and step j-10 below wherein closing of S5 performs the identical function, i.e., stops the motor and applies braking. S5 is able to perform in this manner, however, because the circuit (gate) to which it is connected is in a different condition during each of the steps.

g. While the Fresnel carrier was moving up and prior to motor shutdown, the recock ram driven by the bell-crank opens switch S3. When S3 opens, it signals the integrated circuit to initiate a 40-millisecond delay in the sequence. This amount of time prevents a picture from being taken until mirror bounce has subsided.

h. At the end of the 40-millisecond delay period, the integrated circuit removes power from solenoid no. 1 and the shutter opens. Simultaneously, the circuit starts timing the exposure (integration). The integration components of the integrated circuit are programmed by the signal provided by the photocell. At this same time, the flash delay section of the substrate is made ready but will not function unless a flash array has been plugged in to close switch S2.

i. When power is removed from solenoid no. 1 (and the shutter begins opening), the pin on the plunger returns switch S4 to its original condition (CA closed). When the exposure timing cycle is complete, power is returned to solenoid no. 1 and the shutter closes, opening CA, closing CB, placing solenoid no. 1 again in the power down condition and starting the motor to eject the exposed film.

NOTE: The length of the timing cycle is determined by the amount of light reaching the photocell. If there is insufficient light to correctly operate the integration circuits, the system will automatically terminate the exposure at the end of 20 seconds.

j. When, in the previous step, the solenoid closes the shutter, and the drive motor is energized, the gear train resumes its sequence with the following results:

1. The film pick feeds the exposed film to the spread rolls.
2. At the end of its travel the pick is held in its forward position by the pick latch.
3. Film moves through the spread system.
4. The recock gear cam in the gear train proceeds to move the Fresnel carrier down.
5. The recock ram closes switch S3 to prepare for another exposure.
6. The light stop opens the optical path to the viewfinder.
7. The film completes its passage through the spread rollers.
8. The Fresnel carrier is driven down and is held by the recock ram acting on the recock gear cam.
9. The pick latch releases the pick and the pick returns to its starting position.
10. The recock ram closes S5 to cause the integrated circuit to shut off and dynamically brake the drive motor.

k. If the operator has removed pressure from the exposure button, all power will be removed and the shutter will open to permit viewing. If the button has not been released, the shutter will remain closed until the operator removes his finger from the button.

l. When a flash array is placed in its socket, it closes switch S2. This switch connects the integrated circuit in the flash mode. All of the mechanical sequences will remain as just described. The integrated circuit, however, will now provide power to solenoid no. 2 when switch S5 (in the gear train) opens.

m. Within the shutter housing, a cam follower is driven by a cam on the focus wheel and arranged so that it will mechanically stop the travel of the shutter blades relative to the flash-to-subject distance. When solenoid no. 2 is not energized, its plunger prevents engagement of the focusing cam follower and the shutter mechanism functions in the ambient exposure mode. When the integrated circuit is programmed for flash, solenoid no. 2 is energized and shutter opening is controlled by focusing distance.

n. When making a flash exposure and the shutter blades start to open, the cam interceptor will be set to a position determined by the focusing mechanism but out of the path of the blades. When solenoid no. 2 is energized, it pulls the interceptor into the blade path and stops the blades at the correct aperture for correct flash exposure at the set distance (Figure 1-13). The interceptor latches in this position. At this time, the integrated circuit removes the power from solenoid no. 2. The solenoid, like any inductive device, produces a flyback voltage when its magnetic field collapses. This flyback voltage is used to trigger the integrated circuit which, in turn, applies power to the flash socket to ignite the flashbulb.

o. It is important to be aware that the timing (integration) circuits of the substrate continue to function even though the insertion of a flash array has placed the substrate in the flash mode. Thus, if the ambient light level is high, the picture may be made by ambient light without firing the flash.

p. The shutter performs an additional function in the flash mode. One of its circuits examines the no. 1 flash bulb contacts and by virtue of the resistance determines whether or not the bulb has been fired. If the no. 1 lamp is exhausted, the circuit scans to no. 2, etc. When an unused lamp is located, the firing circuit remains connected to that lamp until it is used.

q. As explained in step o, a flash array on the camera does not inhibit the ambient-mode

function. Therefore, if all the flashlamps are expended and a picture is taken, an ambient-light exposure will result. The photographer will recognize this situation by the absence of a flash. However, he may still get an acceptable picture. The aperture in this case will be determined by the flash-to-subject distance.

F. SHUTTER MECHANICAL DETAILS

The foregoing paragraph describes the electrical inputs and outputs of the integrated circuits (substrate). The following paragraphs describe the manner in which the mechanical components of the shutter respond to either manual or electrical direction. See Figure 2-9.

1. When the operator prepares to take a picture, he first must aim and focus the camera. As he rotates the focus wheel to bring the Fresnel image into sharp focus, a cam molded into the rear surface of the focus wheel moves the component identified as the cam follower assembly on Figure 2-9. The trim link coupled to the trim assembly is also pinned to the cam follower in such a way that follower movement is directly influenced by the setting of the trim wheel. (The trim wheel is the lighten/darken control on the photocell.)

2. When an ambient-light exposure is being made, all of the action just described takes place but does nothing to the shutter action. However, when a flash array is inserted switch S2 in the flash socket programs the substrate to energize solenoid no. 2. The impact of this action on the movement of the shutter blades is described in paragraph F4 but first the shutter blade actuation must be described as follows:

3. When the integrated circuit routes power to solenoid no. 1, the solenoid plunger is pulled into its core. A miniature flexible belt attached to the plunger passes around the opening spring drum of the walking beam assembly. The solenoid plunger pulls the belt which, in turn, rotates the drum and the walking beam. Each of the shutter blades has a pin which engages a slot in the walking beam. As the walking beam rotates, it transmits its rotary motion to the shutter pins and drives the rear blade to the right (facing the front of the shutter) and the front blade to the left thus closing the light path of the picture taking lens and the light path of the photocell lens. When the shutter is totally closed, the gear train has reached the point in the sequence at which the Fresnel carrier snaps up and the exposure sequence takes place. The blades will proceed toward the fully open position and return to

SWITCH FUNCTION TABLE

Switch	Action	Result
1	Closes	Causes circuitry to take and deliver the picture.
2	Closes	Connects circuitry to take flash shots.
3	Opens	Initiates "Y", 40 millisecond delay.
4	Closes	Completes 3 functions: causes the No. 1 solenoid to go into the 'power down' mode, with S2 switches in the flash circuit, and starts the motor.
5	Closes	Stops motor both by closing and opening depending upon sequence of action and internal circuitry.
6	Opens	Disconnects battery from circuitry when camera is folded for carrying.
7	Closes	Connects power between gear train and motor when front cover is closed and latched.
8	Closes	Enables, with S7 closed, the circuitry to eject dark slide.
9	Closes	Prevents firing flash if film pack is exhausted.

closed position in the time interval dictated by the photocell and integrating circuit. The blades may not reach the fully open condition if the illumination level is high, or they may fully open and remain open for a period of time if the light level is low. If a flash array is mounted, the blades may not be permitted to open completely because of the follow-focus mechanism described in part in the foregoing paragraph. The following paragraph explains the interaction of the follow-focus components and the shutter blades.

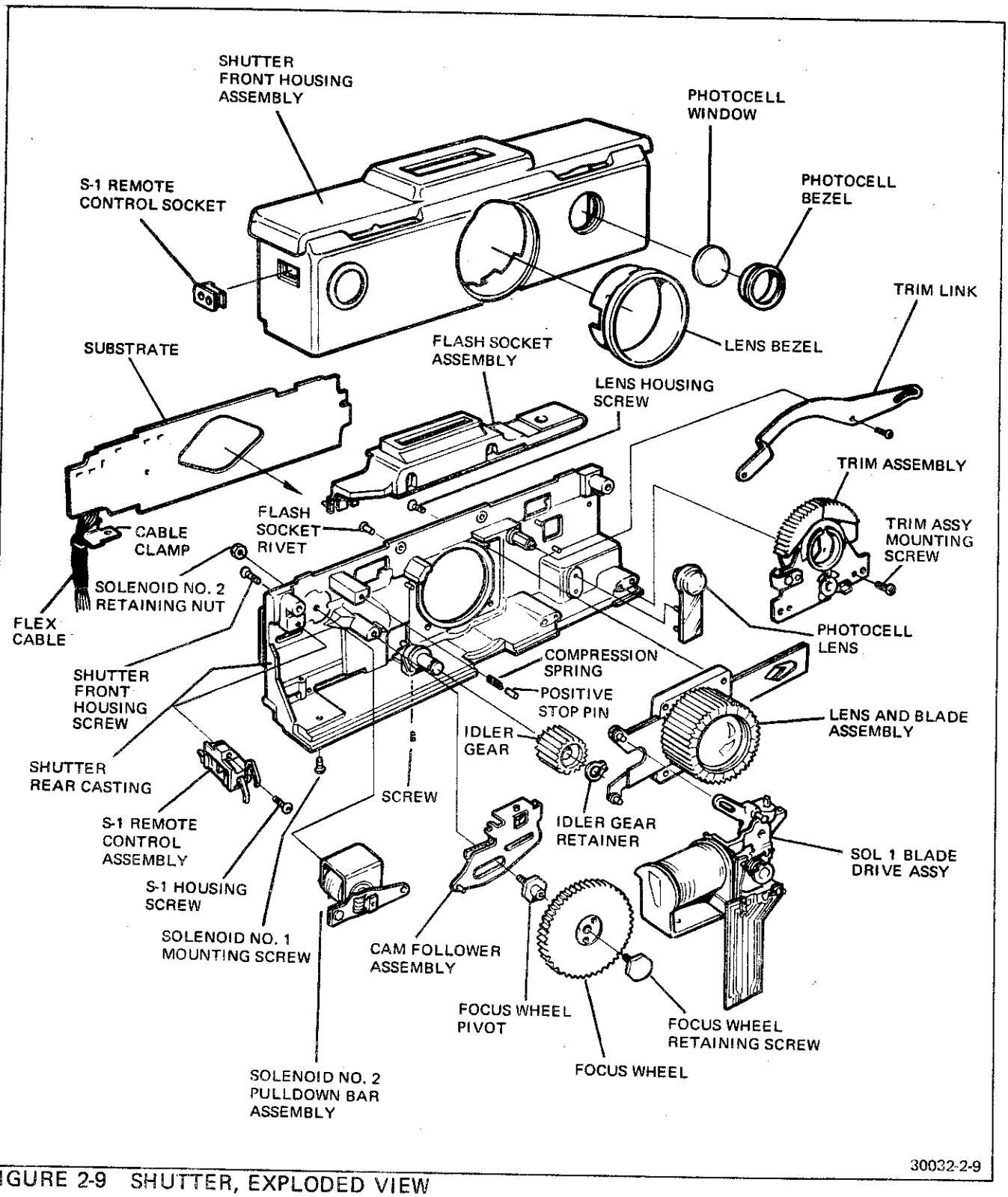


FIGURE 2-9 SHUTTER, EXPLODED VIEW

4. Installing a flash array in the camera flash socket electronically switches the integrated circuit to the flash mode. As previously explained, at a point in the picture taking sequence (flash mode) solenoid no. 2 is energized. Fastened to the plunger is the pull down bar. When the plunger pulls this bar down, it moves the cam interceptor into the position where it will intercept a pin (the follow-focus pin) on the walking beam. Now when the shutter blades move towards the open position, they will be interrupted by the mechanism just described which means that the maximum size of the opening (aperture) is determined by the focus setting of the camera. As the camera (and thus the flash lamp) is moved closer to the subject, the maximum aperture is reduced so that a correct exposure will result. The reverse (greater distance) is also true.

5. The shape of the pin on the walking beam is such that once contacted by the cam interceptor it remains latched in that position until solenoid no. 1 is actuated during the next phase of the shutter cycle. When the solenoid no. 1 plunger pulls in, the follow-focus pin disengages from the cam interceptor and the solenoid no. 2 plunger returns to its original position.

6. Since the photocell components are contained within the shutter housing, they are included in this discussion. A lens is employed to focus the reflected light from the subject on the photocell. A second pair of openings in the shutter blades control the amount of light received by the cell as previously described. A variable neutral-density wedge system is employed to provide lighten/darken adjustments. The operation of this control differs slightly from those used on other Polaroid cameras. When the camera is folded, a cam on the light shield of the front cover strikes a release lever on the lighten/darken assembly and returns the trim adjusting wheel to its center (normal) position. The trim wheel is automatically centered when the camera is closed.

7. To compensate for any variations in individual photocell characteristics, a neutral-density filter is selected and installed in front of the photocell lens during assembly. A calibration must be performed and a filter of correct density installed any time the photocell requires replacement.

G. FILM PROCESSING COMPONENTS

The basic theory of the film processing method remains unchanged from previous Polaroid systems. That is, the developing chemistry is encapsulated in a pod on each sheet of film and, as the sheet is passed between rollers, the pod is burst and the chemical spread evenly between the negative and the mylar protective cover. Except for these characteristics, no direct similarities exist. The SX-70 camera employs a unique process which totally eliminates the "throw-away" negative. The print is drawn through the spread rolls by the motor drive system so that no action need be taken by the operator. See Figure 2-10. Development takes place outside of the camera and is unaffected by ambient light conditions. Since the end result is determined when the picture emerges from the camera, no time measurement is necessary.

H. SEQUENCE OF OPERATIONS

The operator pushes S1, applying full power to solenoid no. 1, which closes the shutter blades, and pushes solenoid no. 1 against S4, changing it from CA to CB. Opening CA cuts solenoid no. 1's power from high to low; low is enough to hold the blades closed. Closing CB starts the motor.

The motor starts the gear train moving. The movement of a cam on the gear train releases the Fresnel carrier to spring action which raises it. As it rises, it drives the recock arm which opens S5 and then S3 at certain Fresnel carrier angles. Opening S5 stops the motor, causing it to have made only a brief jog, and opening S3 starts the Y-delay, a 40-millisecond delay to allow the Fresnel carrier to come to rest (from having been sprung up).

The end of the Y-delay releases power from solenoid no. 1, allowing the springs to open the shutter for exposure, and moving S4 from CB to CA position. The Schmitt Trigger (S/T) collects light energy from the photocell until the sufficient exposure level is reached. This sends full power to solenoid no. 1, which closes the blades and pushes S4 from CA to CB. As before, opening CA cuts solenoid no. 1's power from full to low, sufficient to hold the blades closed; closing CB starts the motor.

The motor starts the gear train moving again, and this time the cam causes a series of actions at different positions of its rotation:

- it starts the pick to pull the film into the rollers (one of which is attached to the gear

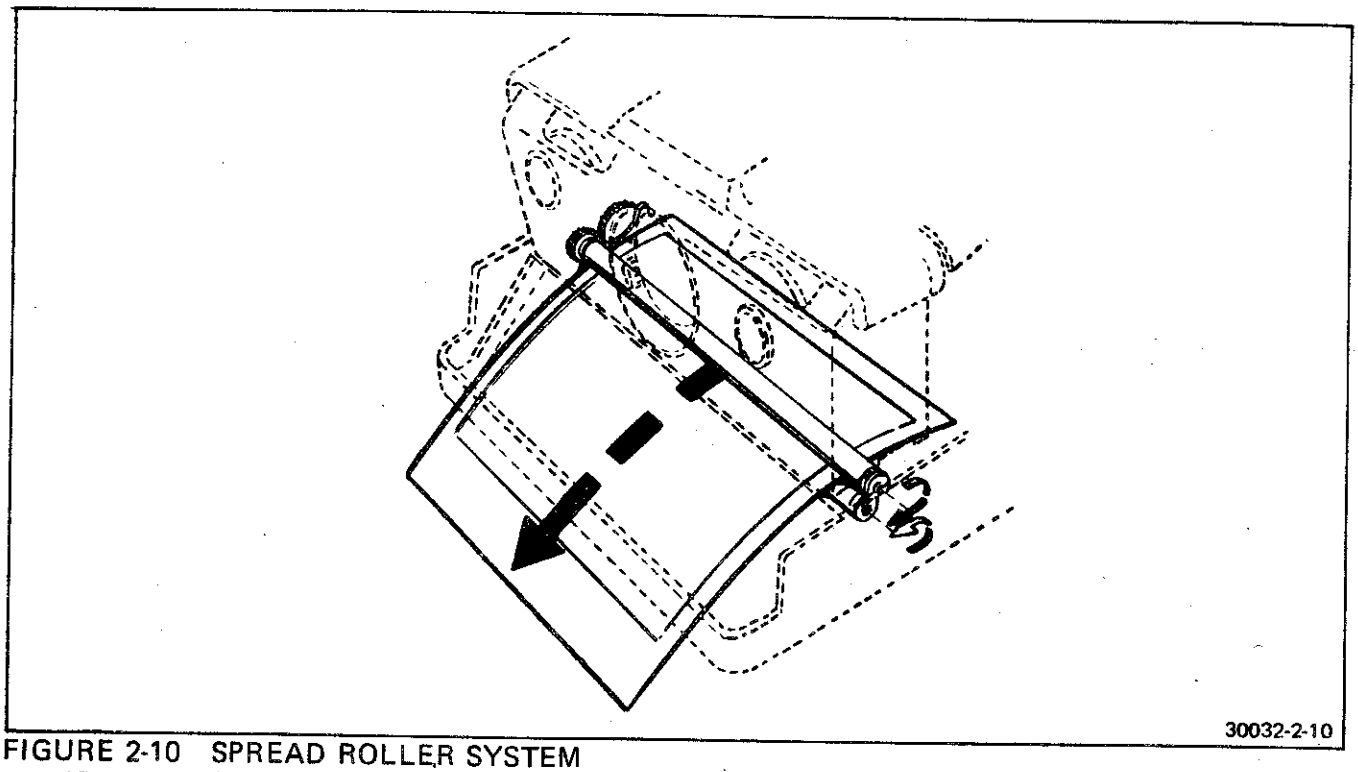


FIGURE 2-10 SPREAD ROLLER SYSTEM

train – it is this powered roller rotation that pulls the film through and out of the camera);

- it stops the pick;
- it pulls down the Fresnel carrier, which, as it moves down, moves the counter and closes S3 (resetting it for the next cycle);
- it stops the spread action;
- it returns the pick;
- it fully recocks the Fresnel carrier (fully down, ready for the next cycle);
- and it closes S5, which stops the motor.

When the motor stops, power stops to solenoid no. 1, the springs open the shutter blades, and S4 is pushed from CB to CA.

The system is ready for a new exposure cycle.

Springs are used in three of the operations discussed above: springs hold the shutter blades open, the Fresnel carrier down, and the pick at its pulled-back position.

As indicated, inserting a pack causes automatic action. This could, of course, be a partial pack: the top sheet of film would be ejected as a dark slide and the counter would register "10". After the last actual sheet is used, the camera would still function until "0" is reached. If a flashbar were attached, and an unused bulb was available after the last film sheet was used, attempting to make another exposure would fire the flash.

The differences in the flash mode are:

Inserting a flashbar closes S2, which activates solenoid no. 2 to move the interceptor link into position. This controls the shutter blades according to focusing: the closer the focus, the more flash light will bounce back, therefore, the smaller the permitted aperture.

At the end of the Y-delay, a flash delay circuit is activated, and when S4 switches from CB to CA, CA switches in the flash circuit. During the fixed flash delay, the photocell and S/T are operative, so that if enough light energy is collected before the end of the flash delay, the blades will be closed by the ambient procedure.

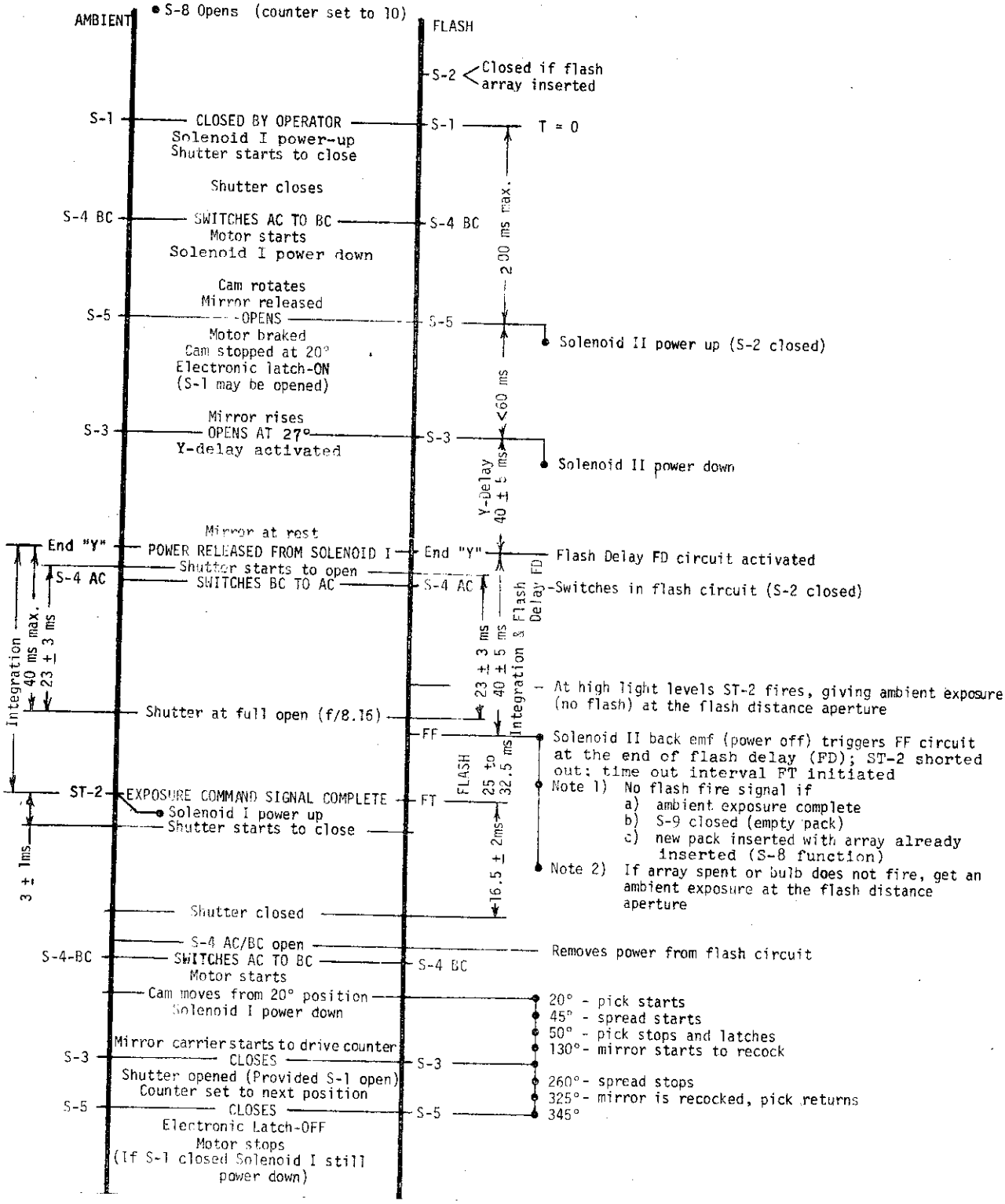
At the end of the flash delay, power is removed from solenoid no. 2, and the discharge (flyback voltage) fires the flash and starts the flash time-out interval (the fixed exposure time). If an ambient exposure has already been made, S/T-2 receives the discharge and no flash or flash time-out occurs.

At the end of the flash time-out , the circuitry energizes solenoid no. 1 which closes the blades. If no flash has occurred, caused by all the bulbs having been used, no signal will be sent to solenoid no. 1, and an ambient exposure will be made. If the S/T has not collected sufficient light energy at the end of a fixed period (20 seconds), the blades will automatically close.

I. EXPOSURE/PROCESS OPERATION SEQUENCE

Polaroid Spec No. 2180
SX--70 Shutter Assembly

- S-9 Opens when previous pack removed
- S-6 Closed during the erecting mode
- S-8 Closed until film cover ejected
- S-9 Open when pack inserted
- Gears mesh as cover closes (3rd & 4th idler)
- S-7 Closes during front cover closure, resulting in film cover ejection


AMBIENT
FLASH
S-8 Opens (counter set to 10)
S-2 Closed if flash array inserted
S-1
CLOSED BY OPERATOR
Solenoid I power-up
Shutter starts to close
T = 0
Shutter closes
S-4 BC
SWITCHES AC TO BC
Motor starts
Solenoid I power down
200 ms max.
Cam rotates
Mirror released
S-5
OPENS
Motor braked
Cam stopped at 20°
Electronic latch-ON
(S-1 may be opened)
Solenoid II power up (S-2 closed)
<60 ms
Mirror rises
S-3
OPENS AT 27°
Y-delay activated
Solenoid II power down
Y-Delay 40 ± 5 ms
Mirror at rest
End "Y"
POWER RELEASED FROM SOLENOID I
Flash Delay FD circuit activated
Shutter starts to open
S-4 AC
SWITCHES BC TO AC
Switches in flash circuit (S-2 closed)
Integration & Flash Delay FD
23 ± 3 ms
40 ± 5 ms
Integration 40 ms max. 23 ± 3 ms
At high light levels ST-2 fires, giving ambient exposure (no flash) at the flash distance aperture
Shutter at full open (f/8.16)
FF
Solenoid II back emf (power off) triggers FF circuit at the end of flash delay (FD); ST-2 shorted out; time out interval FT initiated
ST-2
EXPOSURE COMMAND SIGNAL COMPLETE
Solenoid I power up
Shutter starts to close
FT
FLASH 25 to 32.5 ms
16.5 ± 2ms
3 ± 1ms
Note 1) No flash fire signal if
a) ambient exposure complete
b) S-9 closed (empty pack)
c) new pack inserted with array already inserted (S-8 function)
Note 2) If array spent or bulb does not fire, get an ambient exposure at the flash distance aperture
Shutter closed
S-4 AC/BC open
Removes power from flash circuit
S-4-BC
SWITCHES AC TO BC
Motor starts
Cam moves from 20° position
Solenoid I power down
20° - pick starts
45° - spread starts
50° - pick stops and latches
130° - mirror starts to recock
Mirror carrier starts to drive counter
S-3
CLOSES
Shutter opened (Provided S-1 open)
Counter set to next position
260° - spread stops
325° - mirror is recocked, pick returns
S-5
CLOSES
Electronic Latch-OFF
Motor stops
(If S-1 closed Solenoid I still power down)
345°

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III - TROUBLESHOOTING

A. INTRODUCTION

The SX-70 camera is a computer-controlled device, the computer being the integrated circuits (IC) mounted on the substrate in the shutter housing. Because the IC's are non-repairable items, there is no requirement to trace faults within the integrated circuits. It is mandatory, however, to be able to identify the command inputs (switches open or closed, etc.) and the resulting output signals. The SX-70 Comprehensive Tester provides the readouts necessary to confirm a malfunction but a thorough understanding of the theory of operation is required if meaningful use of the test set is expected. If a particular camera function fails, it is necessary to recognize how the failure relates to the operating sequence of events and thus reduce testing procedures to those related to the area of malfunction.

Because of the camera's total automation it is unlikely that much useful guidance can be obtained from customer complaints except in cases of visible mechanical damage. For this reason, a well-defined series of checks, observations, and tests must be followed. This section of the manual defines these procedures.

The primary purpose of any fault analysis program is to reduce the area of investigation to a minimum in the shortest possible period of time. Thus, it is not only important to establish a fixed routine, but it is mandatory to acquire the maximum amount of information from each step of the checkout procedure. Proceed in the following manner:

B. OBSERVATIONS AND INITIAL CHECKS

Do not make any arbitrary assumptions. An assembly or component should be assumed faulty until it is known to be performing its function correctly.

1. Perform a thorough visual inspection. Carefully open the camera, being alert for evidence of binding and/or any unusual sounds from within the camera. Check the shade blade assembly for evidence of distortion particularly if the damage is serious enough to have caused damage to components within the viewfinder system. Check the erecting link for signs of distortion (Figure 3-1). Carefully examine the boot for evidence of any tears, punctures, or abrasions. Examine any marks on the outer surfaces of the camera that would indicate possible interior damage.

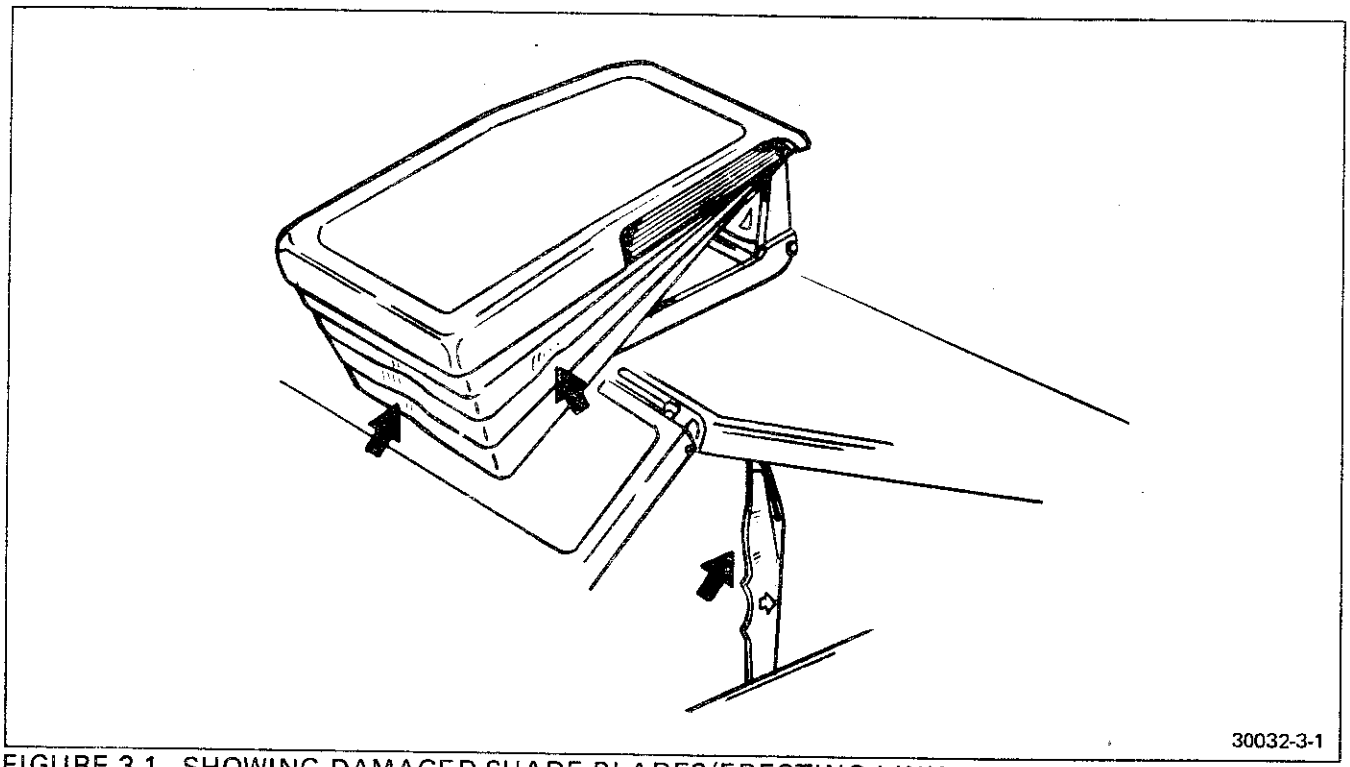


FIGURE 3-1 SHOWING DAMAGED SHADE BLADES/ERECTING LINK

2. Rotate the focusing wheel and trim control wheel (Figure 3-2) throughout the ranges to detect any evidence of binding or interference.

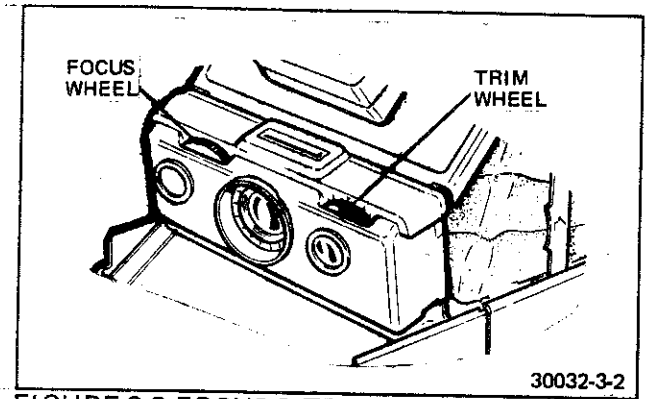


FIGURE 3-2 FOCUS & TRIM CONTROL WHEELS

3. Aim the camera at any adequately illuminated target at any distance within the camera focusing range. Operate the focus control to determine if a sharp image can be obtained. This check does not preclude the possible need for collimation. It does, however, provide a check of the viewfinder optics, the viewing mirror, the focusing mechanism and the lens.

4. Open the front cover. While the cover is open, examine the spread rolls for evidence of dirt or damage. Examine the spread-roll drive gears for evidence of visible damage.

5. Insert a test film pack (the battery must be good) and close the door so that the door latch is engaged. This checks S7 and the front cover operation. The motor should run and eject a piece of film (if pack was partly exhausted) or the dark slide (if the pack was full). If the pack is empty, the camera should still cycle through the ejection sequence. Three main situations can be evidenced.

a. The camera functions as just described.

b. Neither the shutter nor the motor functions.

c. The shutter can be heard to open and close but the motor does not run.

d. Further tests requiring the battery can be made with the film pack simulator (Figure 3-3). The film pack simulator, part no. 11718, consists of two items: a 6 volt, modified Hewlett Packard power supply, part no. B-11775 and the film pack simulator, part no. C-11774. The system provides power to simulate normal operation of the camera.

1. Plug the pack simulator into the power supply being careful to observe polarity. Remove front cover.

2. Set the power supply switch to VOLTS and turn on.

3. Adjust the output to the desired voltage.

4. Set the power supply switch to the AMPS position.

5. In use, the system substitutes for the film pack, giving a steady, reliable source of power.

6. Insert the pack simulator into the camera in exactly the same way as a film pack. Close S7 with actuator.

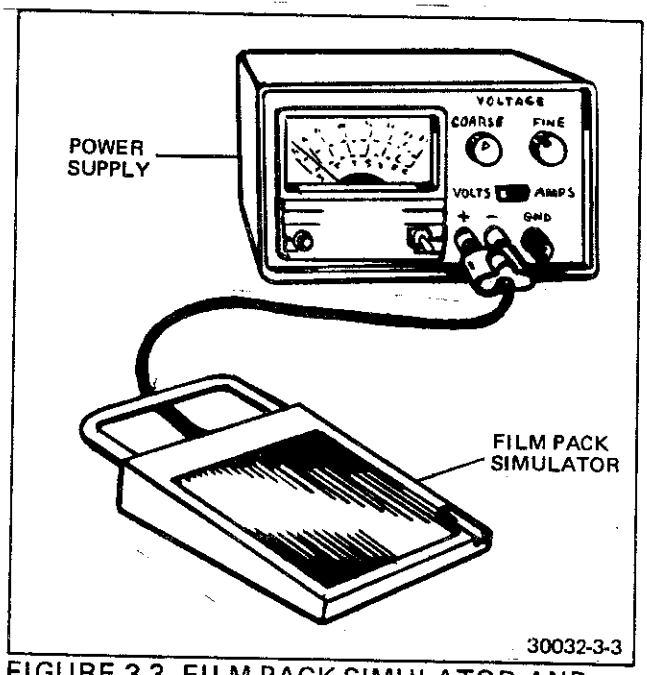


FIGURE 3-3 FILM PACK SIMULATOR AND POWER SUPPLY

6. If the camera correctly cycled through the ejection function, press the exposure button and observe the operation of the camera. If no action occurs (shutter doesn't function and motor doesn't run) the trouble is most likely associated with the exposure button (S1) and/or the connections between the button and the substrate. If S6, S7, or S8 were faulty, the camera would not have performed the ejection function. Check the continuity in the S1 circuit. See paragraph Q2.

7. If neither the shutter nor the motor function, the fault is most likely located in the primary power circuits. These circuits include the battery and its connecting circuitry, switches S6, S7 and S8, and the substrate. These circuits should be checked in the order in which they are mentioned. See paragraph M, page 3-12, steps 1-10.

8. If the shutter functions, but the motor does not run, it is known that solenoid no. 1 pulled in and the pin on the plunger physically actuated S4; but if S4 or its connecting circuits failed, power could not reach the motor. The S4 circuits should be checked for continuity. If S4 is functioning properly, check the motor control circuit (MCC) and/or the motor and the interconnections. See paragraph N, 6 thru 9, pages 3-14 and 3-15.

9. If the shutter blades close and the motor runs but the shutter blades fail to open and close (make an exposure), it means that either S3 failed to initiate the mirror-bounce delay circuits, or the delay circuits are malfunctioning. The switch (S3) and its interconnections must be checked and tests performed on the substrate. Refer to paragraph S, page 3-19.

10. If the shutter opens and closes properly but the motor continues to run during the exposure sequence, switch S5 and its associated circuitry should be investigated. Refer to paragraph S.

11. Switch S2 (in the flash socket) cannot be checked by visual inspection. If there is evidence that a flash problem exists, the malfunction can be localized by the comprehensive tester. See paragraph F, page 3-9.

12. The foregoing checks can be made very rapidly and, if properly analyzed, the use of the test set can be limited to only the suspect areas.

13. Perform an exit pupil check (Figure 3-10) by pointing the camera lens at a light source and, holding the viewfinder eye lens approximately 18 inches from the eye, observe the position of the rectangular or round (later models) stigmatic pupil opening.

14. As a final check before proceeding with the Comprehensive Tester analysis, perform the Entrance Pupil check in the following manner:

a. Insert the Entrance Pupil gauge, Special Tool # 11808, in the shutter lens bezel.

b. Hold the camera at arms length pointed at a light source.

c. Observe the position of the rectangular stigmatic pupil (or the circular wafer lens, if the camera is so equipped). Refer to Figure 3-4 for the correct position of the pupil opening. The opening should fall within the parallel lines in the center of the gauge. This is the ideal. Acceptable, however, is finding the pupil located anywhere within the outer parallel lines. If this does not occur, the pupil is to be adjusted to pass this test as follows:

1. Remove leather from the mirror cover.

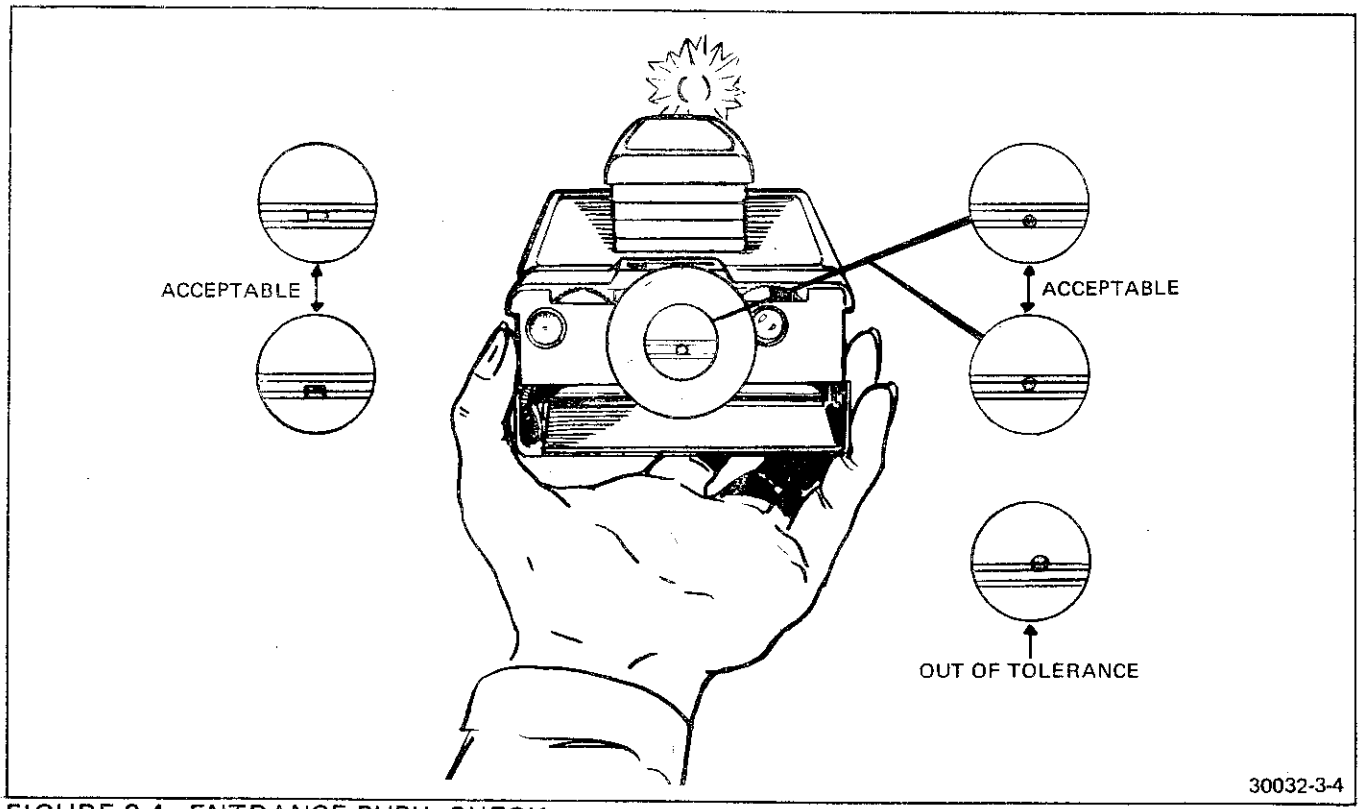


FIGURE 3-4 ENTRANCE PUPIL CHECK

2. Loosen the two erecting link screws and the adjacent mirror cover to boot retainer screw (Figure 4-17).
3. Slide the foot of the erecting link in either direction while observing the entrance pupil through the gauge.
4. When the entrance pupil is centered, hold the link steady and tighten the three screws.
5. Recheck as before after the screws are set.

C. DESCRIPTION OF OTHER TESTS

The following paragraphs describe specific tests to be performed on the SX-70 camera to identify and correct faulty operation. It will seldom be necessary to perform all of these tests; only those related to a particular malfunction. In some cases, the customer's complaint will be sufficiently specific to indicate the need for a particular test. In other cases, the preliminary inspection will provide useful information. In all cases, the fault-analysis charts present the logical sequence of checks and remedial procedures. The paragraph headings in this section of the manual are directly related to specific blocks on the charts. When a test is called for, locate the proper instructions by reference to the Table of Contents, Section III, and perform the tests accordingly. If repairs and/or replacements are indicated, the procedures are described in Section IV.

To expedite the repair procedure, it is essential that the malfunction be isolated to either the camera back or the shutter as early as possible in the troubleshooting procedure. The sequence of the following paragraphs have been arranged to achieve this objective. The sequence should not be considered inflexible, however. If preliminary inspection and/or customer-furnished information leads to a specific area of malfunction, that area could be investigated first.

D. COLLIMATION

When performing several of the Comprehensive Tester checks, a requirement of the test is that the camera lens be correctly collimated. For this reason and because the lens can be checked simply and rapidly, the collimation checks should be performed first.

Although the SX-70 camera can be focused to produce sharp pictures from infinity to 10.4 inches, it is not equipped with distance calibration markings. Adjustment is accomplished by changing the gear mesh between the focus wheel and the lens barrel to produce a sharp image on the Fresnel Screen.

1. Use the SX-70 Collimator. (Tool No. 321564) (Figure 3-5). This instrument incorporates a rear-illuminated focusing target so that no additional equipment is needed. Turn on the collimator light source.
2. Open the camera front cover and slide the camera onto the horn of the collimator. Make sure that the camera is all the way on the horn so that the camera is captured by the spring latches.

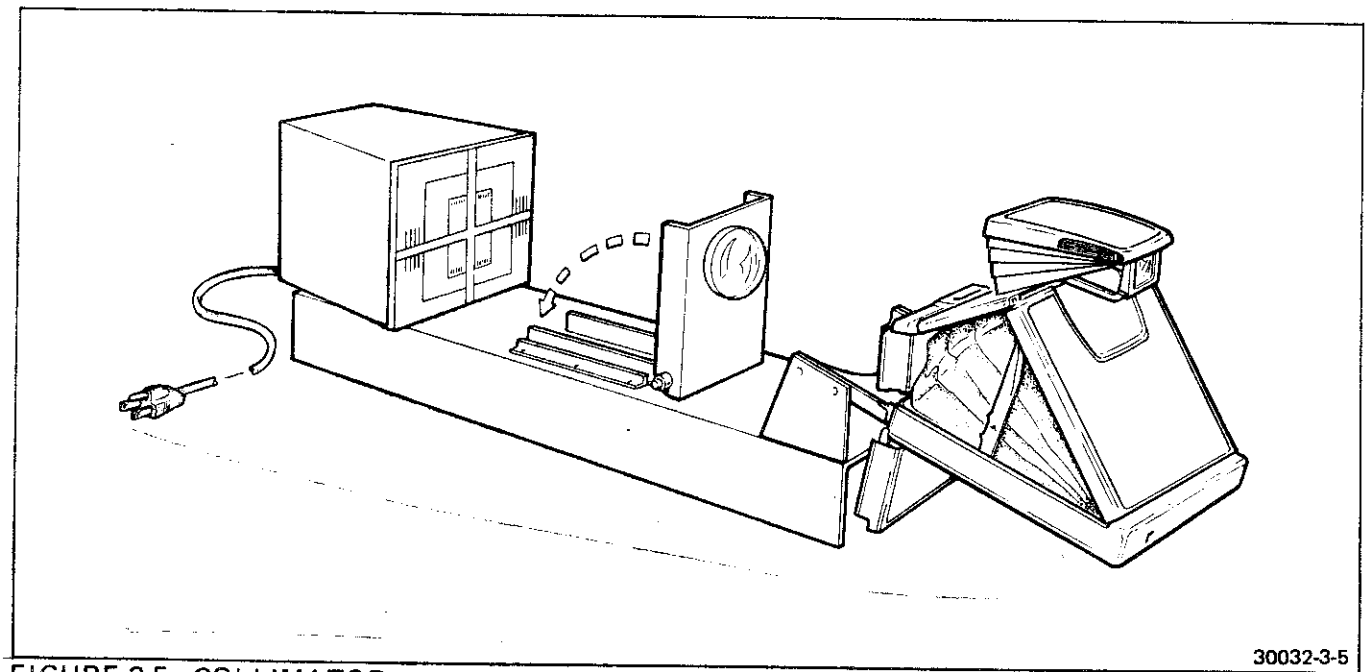


FIGURE 3-5 COLLIMATOR

3. Swing the collimator lens to its vertical position.

4. Look into the camera viewfinder, turn the focus wheel counter-clockwise until the image appears sharp. Look at the collimator center target, top groups of lines and note the number .63. This number and the lines should have maximum clarity as the focusing wheel reaches infinity.

5. If the wheel stops BEFORE this point, remove the camera from the test stand, remove camera front door (Section IV - A). Loosen the adjusting screw at the bottom of the shutter housing so that the idler gear no longer engages the focus wheel and lens barrel. Return the camera to the collimator and adjust the infinity focus manually by rotating the lens barrel.

6. Remove the camera and tighten the adjusting screw.

7. Return the camera to the collimator and verify the infinity setting.

8. Swing the collimator lens to its horizontal position. This is for 10.4 inch distance.

9. Focus the lens for sharpest definition.

10. There is no separate close-focus adjustment on the camera. If the focus wheel has reached its stop before maximum resolution is achieved, return to the infinity check. If there is any tolerance at that setting, readjust the infinity setting as close as possible to the focus-wheel stopping point and recheck the close focus. If it is still impossible to obtain a sharp image, the lens is defective and must be replaced.

11. The foregoing tests assume that when the camera is operated, the viewing mirror (Fresnel carrier) reaches the correct attitude during the exposure cycle. If the lens has been correctly collimated, the only check possible of actual picture definition is to expose a film.

E. VIEWFINDER QUALITY CHECK

"Viewfinder quality" means general optical quality and alignment, and from the user's viewpoint is the clarity and general appearance of the viewed image. (Viewing system – Figure 3-6.)

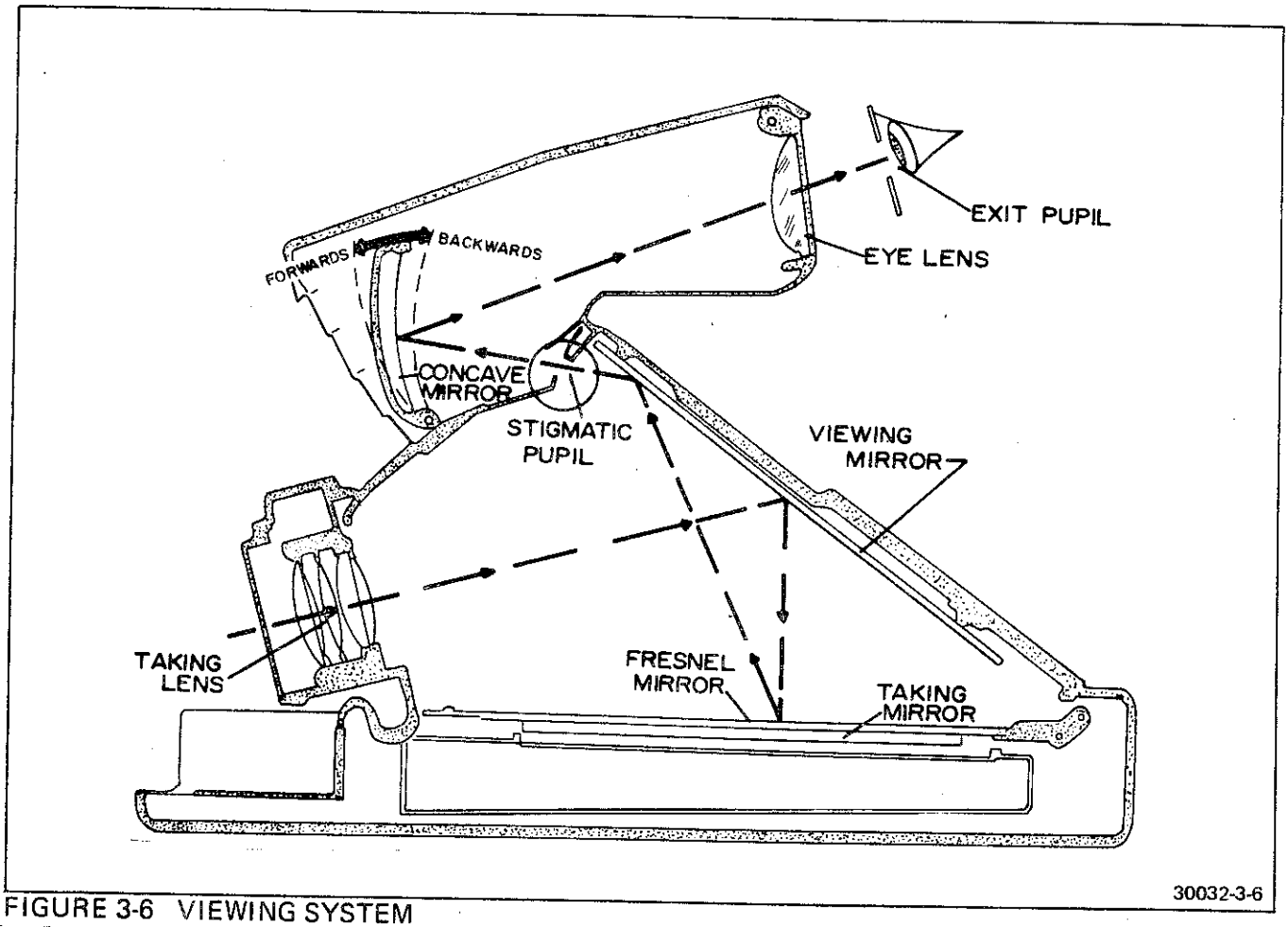


FIGURE 3-6 VIEWING SYSTEM

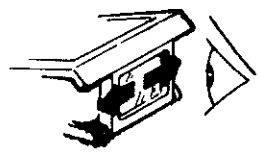
When a camera has poor viewfinder quality, it is difficult to obtain a sharp image; certain parts of the field always seem out of focus, the image lacks crispness, having a blurry or hazy appearance usually in the vertical direction. Since accurate FLASH exposures are dependent upon accurate focusing, a poor viewfinder will make the taking of well exposed flash pictures more difficult.

Procedure:

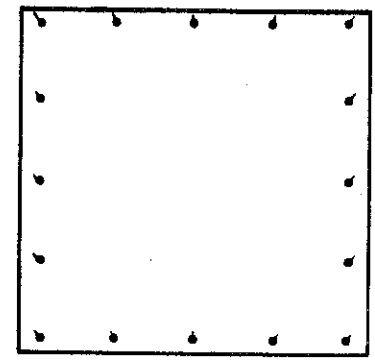
1. Make sure all viewfinder system optics are clean. Use lens tissue.
2. Place camera on collimator fixture-camera and collimator set at infinity.
3. View the illuminated dots along the top of the collimator target (Figure 3-7). Scan your head left, right, up and down. This is referred to as "scanning the exit pupil". You will see streaks stretch upward from the dots, these V's or 'rabbit ears' change length and direction as the eye is moved. Normally they lengthen as the eye is moved to the extreme portions of the exit pupil, i.e., before part of the field is cut off. (Sources at left (streaks) are longer when the eye moves to the left, etc.) (see Figure 3-7).
4. With the eye centered, the 'rabbit ears' should be minimized. Now change the adjustment of the concave mirror either by altering the screw setting or pressing down on the viewfinder cap, (the latter, of course, permits adjustment in one direction only). As the adjustments are made, pay particular attention to the top rows of lights. If the top of the mirror is too far backwards (towards you), the lights appear to be vertical lines; with little or no 'rabbit ears'. If it is too far forward, the length of the 'rabbit ears' increases (Figure 3-8). While looking for these effects, it is important that you allow your eye to roam over the aperture (exit pupil). It is usually sufficient to pay attention to the lights along the top portion of the field alone. (These lights change the fastest with the mirror motion because the top portion of the mirror is furthest from its pivot point). Adjust the mirror to the least amount of spread or blur. This occurs where there is a small amount of 'rabbit ears' (see Figure 3-7).
5. If you are unable to find a mirror position with a minimum blur, open the shade blades and displace the curved mirror sidewise. There is excess slop on some cameras that result in a decentering of the curved mirror. This is visible by noticing the length of the 'rabbit ears', on either end of the top row. Non-symmetry of the 'ears' indicates non-symmetry of the mirror. Adjustment can be made to compensate for this error (see Figure 3-9) by means of a special shim. Use either a red or blue colored shim – differing thicknesses. Slip the shim over the right hand pivot of the concave mirror housing and press it down as far as it will go (Figure 3-9). Recheck viewfinder quality.

   If the spot pattern improves to acceptable standards with the shim installed, then you have solved the problem. If the problem is caused by front and back play of the concave mirror at the pivot points, a new spring (the positioning spring) is to be installed to overcome this difficulty. See Figure 3-9 for the shape of the spring and the relative orientation where installed.

   With the viewfinder cap and the shade blades removed, position the concave mirror and let it lie folded. Place the two half arrow tips of the spring facing the mirror housing with the



SCANNING EXIT
PUPIL LEFT & RIGHT



30032-3-7

FIGURE 3-7 COLLIMATOR TARGET

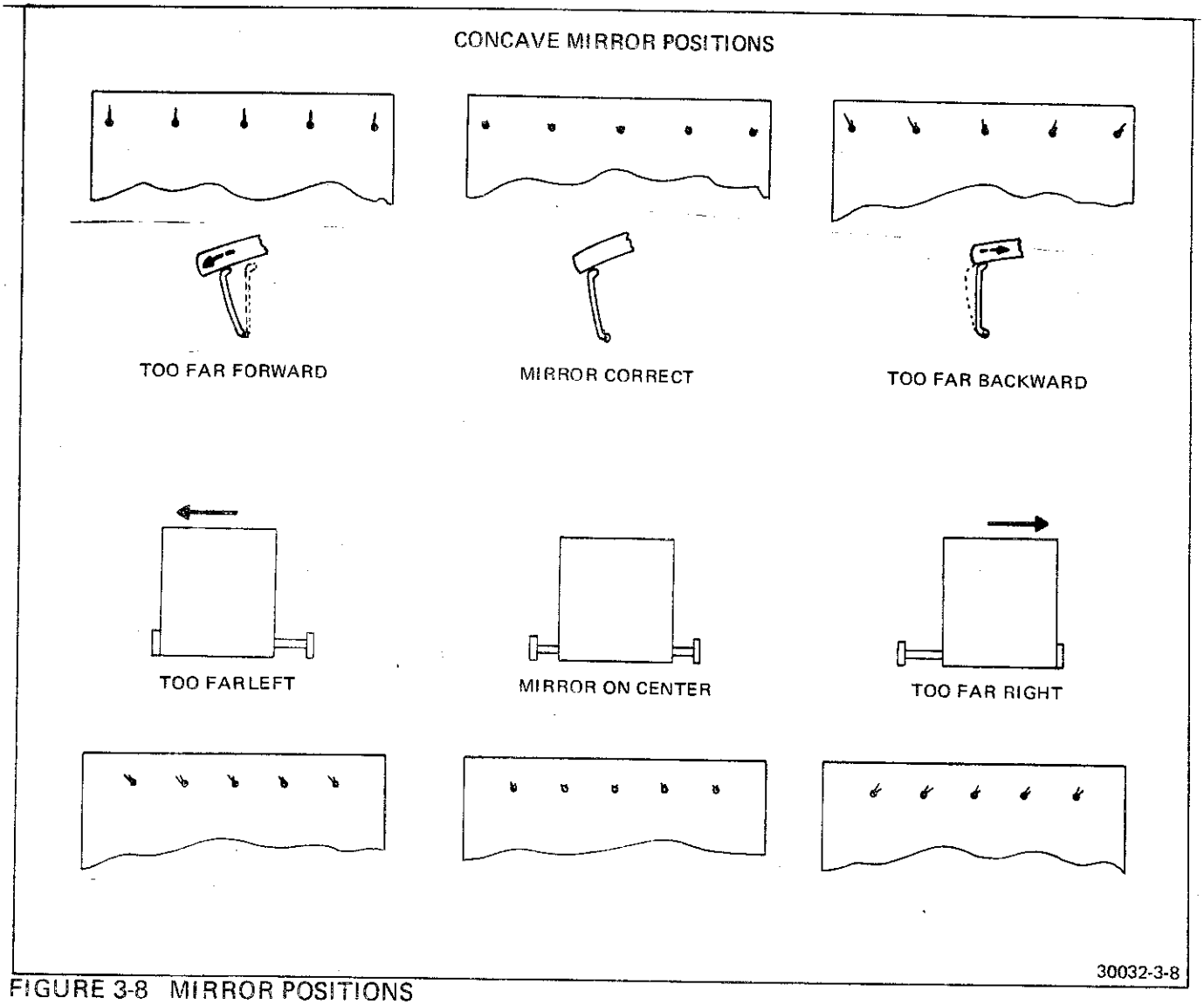


FIGURE 3-8 MIRROR POSITIONS

round curl of the spring facing up, slide the tips under the pivot points of the concave mirror until round curls of the spring touch the mirror housing. Reassemble shade blades, etc.

6. If, after all of the above adjustments are attempted without obtaining satisfactory results, then the problem is due to the mislocation or misalignment of the stigmatic pupil or eyelens. Follow these steps:

a. Examine the exit pupil by holding the camera at arm's length. The pupil shoud be rectangular with sharp clean edges or circular. Any obstruction is due to the misalignment of the stigmatic pupil with the opening in the boot.

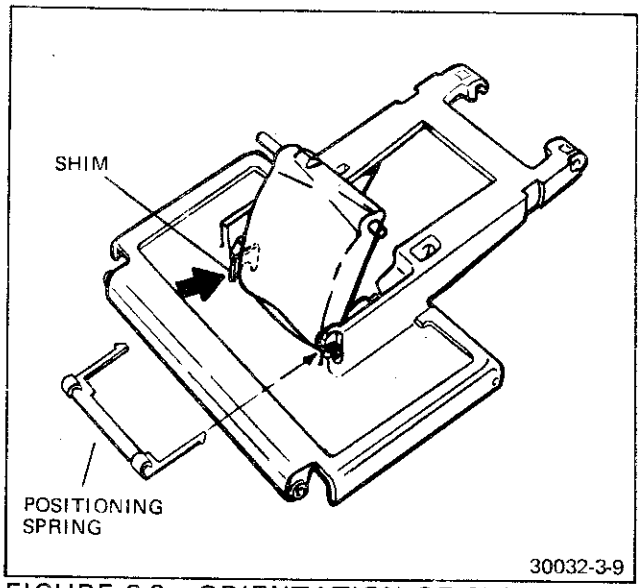


FIGURE 3-9 ORIENTATION OF SHIM AND POSITION SPRING

An extra opening (crescent or "cat's eyes") as viewed by tilting the camera upward and looking above the aperture also indicates misalignment of the pupil with the boot as shown in Figure 3-10.

b. Rotate the camera at arm's length so the pupil gets higher and then lower. See Figure 3-11. The pupil should disappear in the eyelens at approximately equal distances from the top and bottom of the eyelens frame as shown below. If it doesn't, examine the stigmatic pupil to insure that it is properly attached to the short cover and is not loose.

c. In the event that you are working on a later model camera equipped with a wafer lens (Figure 2-4) instead of a stigmatic pupil, the exit and entrance pupil checks are also different.

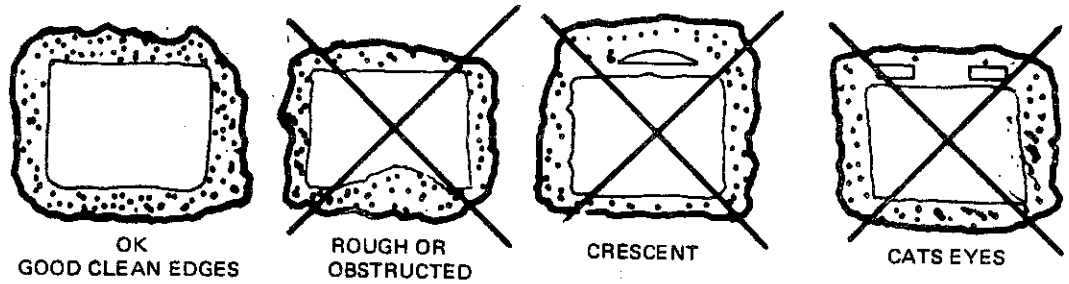


FIGURE 3-10 EXIT PUPIL CHECK

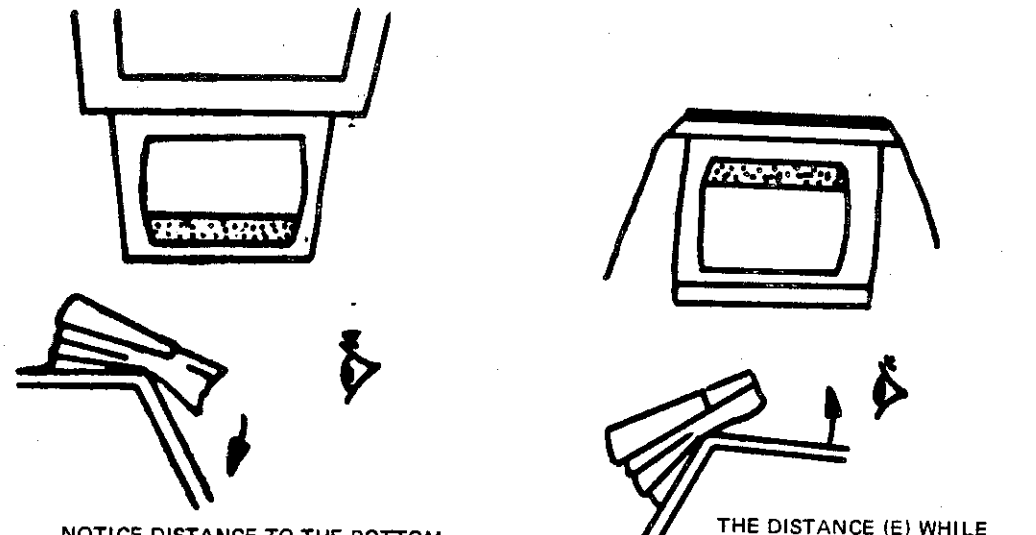


FIGURE 3-11 CHECKING DISAPPEARANCE OF EXIT PUPIL

d. Check for entrance pupil by holding the camera with the lens facing you. Look for a round image formed in the lens. The top edge of the circle image should be approximately .040 inches below the horizontal centerline of the lens or use entrance pupil gauge as described in paragraph B-14. If not, adjust the erecting link as previously described. Recheck, and, if correct, proceed with the check.

At a distance of 3½ feet, view a target with fine lines (newsprint). Frame the image and focus as sharp as possible.

Slightly depress the viewfinder cap and note if the image becomes sharper. If so, adjust the setscrew inside the viewfinder cap. Turn the screw clockwise and recheck. See Figure 3-12.

If the image becomes worse or distorts, turn the adjusting screw counterclockwise and repeat step 3 until optimum resolution of the image is observed.

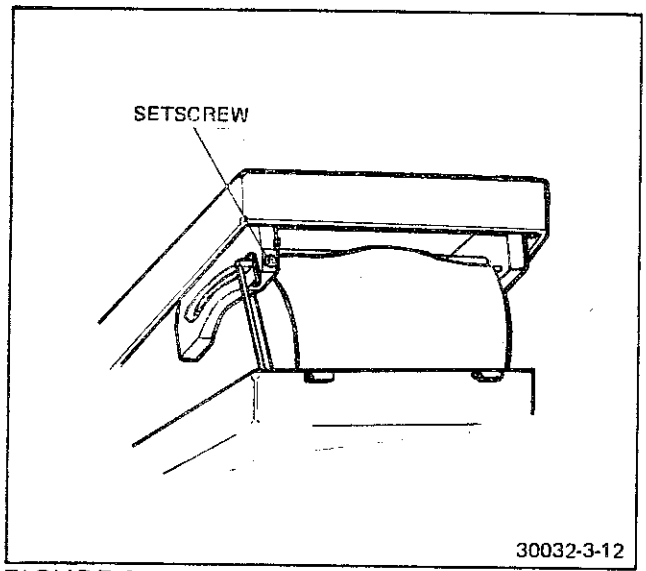


FIGURE 3-12 VIEWFINDER SET SCREW ADJUSTMENT

e. Identifying distorted concave mirrors.

1. Follow steps outlined in Manual in Section III, paragraph E, Viewfinder Quality Check.
2. Additional checks can be made by focusing on a vertical line target, such as a door frame, etc. Scan the camera horizontally. If good, the mirror vertical line will vary from slightly bent to the outside of the image, through straight to slightly bent, (in the opposite direction) to the outside of the other edge of the image (Figure 3-12A).
3. If the mirror is distorted, the vertical lines change more graphically as the image is scanned and one or several reversals of direction of bending may occur (Figure 3-12B).
4. A telephone directory target at a distance of 2 feet may be used to check distortion. The white pages have high contrast, fine detail and uniform printing.
5. The frame around the viewfinder may appear nonsymmetrical about the vertical axis. A normal mirror will appear to be symmetrical about the axis (Figure 3-12C).

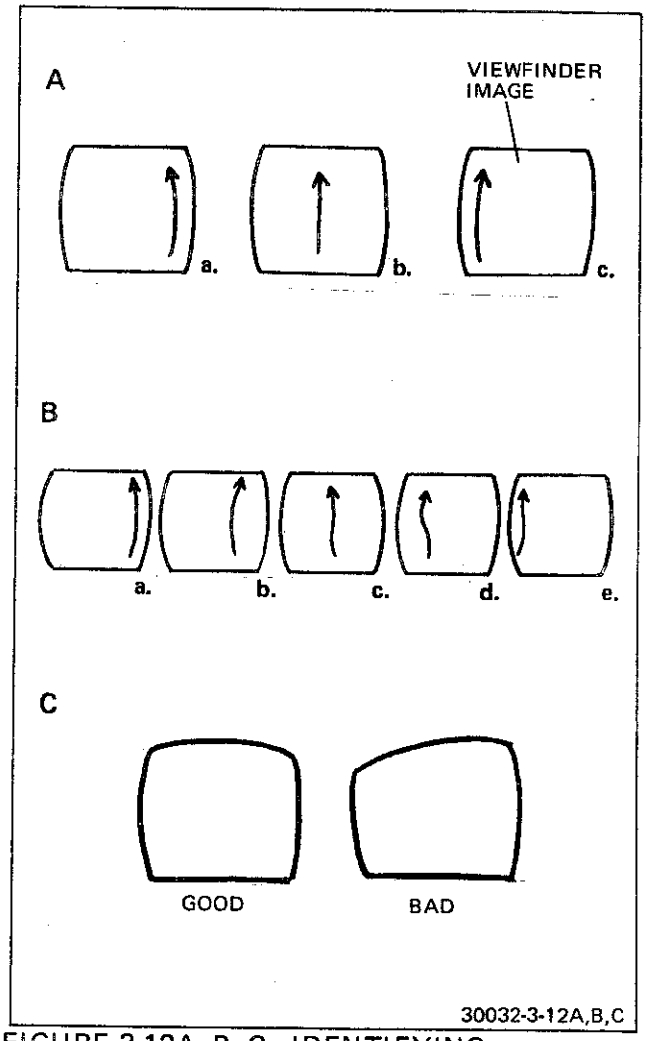


FIGURE 3-12A, B, C IDENTIFYING DISTORTED MIRRORS

F. THE COMPREHENSIVE TESTER

The Comprehensive Tester (Figure 3-13) consists of three interrelated units; the Light Box, the Electronic Module and the power supply. The light box encloses the adjustable lamp and the necessary filters to provide a calibrated source of illumination for the shutter speed and opening tests. The front panel of the light box includes the horn for mounting the camera, the light-level selector, the flash simulator module, the focus wheel actuator, and the exposure button actuator. Two panel mounted meters indicate the camera supply voltage and the current being drawn during the tests. The electronic module contains the necessary power supplies and the electronic circuitry needed to provide the readouts required to perform the tests. The readouts are displayed on five panel-mounted meters: **exposure, aperture, battery drain, flash sync., and flash time out.**

The Comprehensive Tester provides checks on all of the dynamic operating functions of the camera so that fault analysis can be limited to a specific function. The test set will not, however, identify a specific component or assembly as the source of malfunction. This Section of the Manual contains the procedures required to locate a faulty component based upon the test readouts. For more detailed information and calibration instructions, see the special Comprehensive Tester Instruction Manual.

G. PRELIMINARY INFORMATION CONCERNING THE TESTER.

1. When a sequence of tests is performed, the EXPOSURE meter readings for both ambient and flash tests should be equal within a reading of 0.2 at any setting of the trim wheel. This same effect is shown for the Follow Focus test below.

2. The FLASH SYNC meter readings and the FLASH TIME OUT meter readings are indicative of shutter blade operation during flash mode tests. The EXPOSURE meter readings and APERTURE meter readings are indicative of blade speeds during ambient mode tests. The EXPOSURE readings and APERTURE readings are inversely related. The tester does not provide SPECIFIC blade speed data presently, but knowledge of the test procedures provides a guideline for troubleshooting blade speed problems.

3. During a flash mode test, if switch S2 on the flash simulator assembly is opened (AMBIENT) the camera should cycle through a 20 second (maximum) exposure, as shown on meter.

4. During flash mode tests, the backlash in the follow-focus mechanism can be checked in the following way: take a series of 3 aperture readings at 8 feet. The first will be taken by rotating the focus wheel to infinity, back to 8 feet and then take a reading; the second will be by rotating the focus wheel to 10.4 inches, then back to 8 feet and take a reading; the third will be taking a final reading of 8 feet without turning the focus wheel. Consult the specification sheet; if the readings observed are within the current valid requirements, they are acceptable.

5. Setting the light level at 800 provides enough illumination of the camera interior through the viewing system. The extent of light on the Fresnel sereen can be observed, and traces of dirt, blemishes, scratches, etc., can be evaluated.

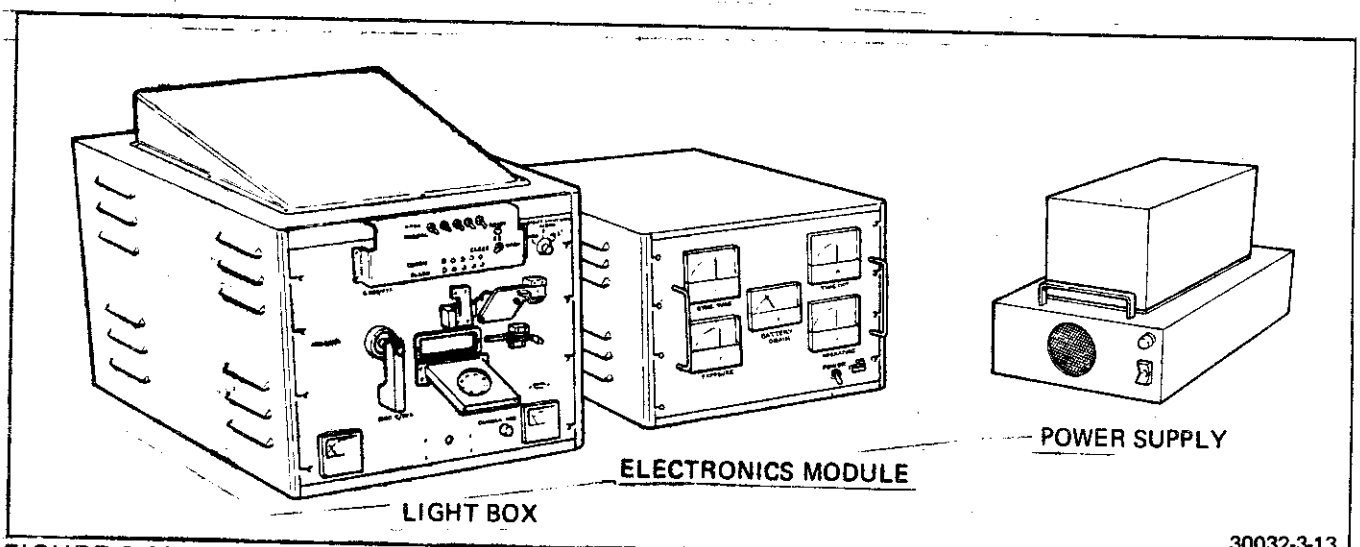


FIGURE 3-13 COMPREHENSIVE TESTER

H. INITIAL CHECKS TO BE PERFORMED

The following initial checks can be performed before mounting the camera on the horn and prior to making other special tests.

1. Remove the front cover from the camera.
2. Set the L/D control to the mid-range position using the trim reset cam and focus the camera at infinity.
3. Push the S7 switch actuator clamp special tool #11716 in on the right side of the camera until the S7 contacts are closed. Then release the S7 switch closer, so that it is clamped in place and is holding the S7 contacts closed.

I. AMBIENT MODE EXPOSURE TEST

1. Check to make sure the S2 switch is in the OPEN position. Set voltage to 5.8 volts.
2. Set the light level selector to the desired 100 light level.
3. Slide the camera over the horn on the tester. The camera should go through the dark slide (S8) cycle. If not, remove the camera from the horn, determine the cause of failure, and correct the dark slide operation. If the camera cycles correctly, push the simulator flash plug all the way down into the flash socket.
4. Check the current meter on the lower left-hand corner of the light box. This meter should indicate zero amperes after the dark slide is ejected. If the meter indicates that the camera is drawing current, remove the camera from the horn, isolate the cause of the current being drawn, and make the necessary adjustments or repairs. If the meter reads zero, the tests that follow may be performed.
5. Depress the exposure button and hold depressed while observing the exposure meter. (When the exposure button is released, the meters will automatically reset.)
6. The camera should perform a complete exposure cycle. Observe the reading on the EXPOSURE meter and compare with current specifications. Record the reading.
7. Observe the BATTERY DRAIN meter. The reading should be according to current specifications. This test applies only to the first exposure of a series.
8. Release the exposure button actuator. All of the meters will reset automatically.
9. Repeat steps 5 through 8 twice for a total of three times. The exposure readings obtained must be within current specifications.
10. Move the light level selector to 6.25. Repeat steps 5 through 8. The test set readings should agree with current specifications.
11. Move the light level selector to 800. Repeat steps 5 through 8. All readings must agree with current specifications.
12. Repeat paragraphs 10 and 11 twice. The test readings obtained must be within current specifications.
13. The camera must be recycled to perform the next series of tests. Raise the flash simulator plug clear of the camera flash socket. Slide the camera off.

J. FLASH MODE EXPOSURE TEST

1. Slide the camera onto the horn and lock with the flash simulator plug. Set 5.0 volts on the tester voltmeter. Set light level at 6.25 and close S2.
2. Depress the exposure button. If the camera circuits are functioning properly, the camera should cycle, the number one READY lamp should go off and the number one FLASH indicator lamp should light.
3. Depress and release the exposure button four more times. The READY lamps should go off and the FLASH indicator lamps should light in numerical sequence each time the exposure button is depressed.
4. Press and release the RESET button on the flash simulator assembly.
5. Depress and release the exposure button five more times. The READY and FLASH indicator lamps should sequence as in step 3, if the camera circuits are functioning properly.
6. On the flash simulator assembly, depress and release the RESET button.
7. Depress the exposure button actuator. The number one READY indicator lamp should remain lighted and the number one FLASH indicator lamp should not light. (Checks S9.)

   NOTE: The toggle switches on the flash simulator assembly can be used to simulate normal or used flash lamps. Be setting the individual switches, partially exhausted or defective flash bars can be simulated.

8. Trim wheel effects should be tested per the follow-focus test instructions.

K. TRIM-WHEEL CHECK (AMBIENT)

Perform initial checks.

1. Set the light-level selector at 100.
2. Depress and hold the exposure button actuator.
3. Record the EXPOSURE meter reading.
4. Remove the camera from the test set and set the trim wheel to the maximum darken position (fully counterclockwise).
5. Reinstall the camera on the tester and engage the flash simulator plug.
6. Depress and hold the exposure button actuator. The EXPOSURE meter must indicate no greater difference than current specifications relative to the step 3 reading.
7. Raise the flash simulator plug, remove the camera from the tester, and set the trim wheel to its maximum LIGHTEN position (fully clockwise).
8. Reinstall the camera and engage the flash simulator plug.
9. Depress and hold the exposure button actuator. The EXPOSURE meter must indicator no greater difference than current specifications relative to the step 3 reading.
10. Raise the flash simulator plug, remove the camera from the tester and reset the trim wheel to NORMAL.

L. FOLLOW-FOCUS TEST

The follow-focus test is used to determine how well the shutter blade opening follows the focusing of the lens in the flash mode of operation. The APERTURE meter is used in this test. It is calibrated in stops and when the test is performed, it will indicate stops deviation from the design aperture. To perform the follow-focus test, proceed as follows:

1. Set the camera focus to infinity. (The lens is turned all the way in when set at infinity.) Set the L/D control at its mid-range position.
2. Remove the front cover from the camera and install the S7 switch closure as described under "Initial Checks to be Performed".
3. Install the camera on the horn of the tester. The camera should go through its dark-slide cycle.
4. Install the flash simulator plug into the socket on the camera and close the S2 CLOSE-OPEN switch.
5. Set the focus wheel actuator to infinity. (Match camera focus setting.)
6. Set the camera supply voltage to 5.8 volts, using the tester VOLTAGE ADJUST control, if required.
7. Engage the focus wheel actuator with the focus wheel on the camera and rotate the focus wheel to 10.4 inches or the 8 foot position.
8. Set the light level selector to 800 cdls/ft^2.
9. Set the flash mode aperture switch to 8 ft. or 10.4 inches as selected in step 7. Perform the test at both 10.4 inches and 8 foot settings.
10. Block any light from the photocell on the camera using a square of cardboard or other material.
11. Depress the exposure button and observe the APERTURE meter.
12. Readings must conform with current specifications.
13. If the reading is high at the 8-foot setting, and the needle goes off scale at the 10.4 inch setting, the interceptor mechanism is defective. Repair as described in Section IV.
14. If on-scale readings are obtained but the 10.4-inch reading is either high or low, the interceptor can be adjusted (Section IV). The problem can be either the interceptor link or the interceptor cam.
15. When adjustments/repairs are complete, recheck the follow-focus function.

M. DARK-SLIDE FUNCTION

When a film pack is inserted into the camera and the front cover or S7 is closed, the blades should close and stay closed through the dark slide (or a film from a partially exhausted pack) eject. The motor should run and the Fresnel carrier should raise. Fault Analysis Chart No. 1 presents a logical series of tests based upon the dark-slide-eject performance. Referring to Chart No. 1, proceed as follows:

1. Open the film compartment and insert a film pack which contains a good battery. The camera will either complete a cycle as just described or will malfunction in one of three ways:

a. No action will occur when the pack is inserted.

b. The camera will start the cycle but the motor will stop before the cycle is complete.

c. The camera will run continuously and keep repeating the eject cycle.

2. If the camera performs the eject cycle correctly, skip the following checks and proceed directly to paragraph Q and Fault Analysis. Chart No. 2.

If Malfunction

If, upon insertion of a film pack, no action of any kind occurs, it is first necessary to determine if the camera is drawing current. The SX-70 power supply simulator (Figure 3-3) is equipped with a voltmeter and an ammeter. It includes the adapter which is substituted for a film pack to provide power to the camera for making tests. Check the current in the following manner:

NOTE: During the following tests, polarity indications refer to the TEST METER leads, not for the test points used.

1. Adjust the power supply to 5.8 volts.
2. Insert the adapter into the film compartment of the camera. Assuming no dark-slide-ejection function, there can be a zero current indication or a high-current (in excess of 1.00 amperes) indication. The no-current condition is described first in the following paragraphs.
3. Following the procedures in Section IV, paragraph AA, remove the camera bottom cover to gain access to the flex circuit.

   NOTE: For location of the following test points, see Figure 3-26, page 3-28.

4. With the adapter in the camera and the power supply turned on, check for 5.8 dc volts at TP-1 battery (–) and TP-2 battery (+) using the Triplett Model 801 VOM. If 5.8 volts is present at these two points, check at TP-3 (8 – 10 pad) (–) and TP-4 (8 – 10 pad) (+). If the correct voltage is present at 1 and 2 and not at 3 and 4, the fault lies in the soldered connections, the battery contacts, or the flex circuit itself. If the correct voltage is present at 3 and 4, proceed to step 5.
5. Check for 5.6 volts at TP-5 (–) and TP-6 (+) on the shutter substrate. To gain access to these two points, remove the shutter housing. See Section IV. If the correct voltage is present at these two points, the fault lies within the substrate circuits. Replace the substrate as described in Section IV. If the voltage is not present at 5 and 6, check and repair the solder connections or the multiwire cable.
6. If in step 2 the camera current was greater than 1.00 amperes, proceed as follows:
7. With the VOM, check for 5.6 volts between TP-5 (–) and TP-7 (+) (Sol 1). If the voltage appears at TP-7, move the positive test lead to TP-8 (Sol 1+; S4C). The voltage at TP-8 will be something less than 5.6 (due to the solenoid coil resistance) but if voltage is present at both solenoid terminals and the solenoid does not pull in, a mechanical bind is indicated and the solenoid must be removed and repaired or replaced. If the voltage is present at TP-7 but absent at TP-8, the solenoid coil is open and the solenoid must be replaced.
8. If there is no fault in the solenoid, check the motor. Two conditions could cause the motor to draw excessive current; a mechanical overload, or an electrical short circuit. Remove the power-supply simulator and remove the camera bottom cover (Section IV). Lift the flex circuit, Section IV, paragraph V, to expose the motor connections (Figure 3-14) TP-9 motor (–) and TP-10 motor (+). Use the Triplet Model 801 VOM and check the resistance across the two test points (motor contacts). It should be approximately 2 ohms. If the motor resistance is low, replace the motor and retest. If the resistance reading is correct, check the gear train.

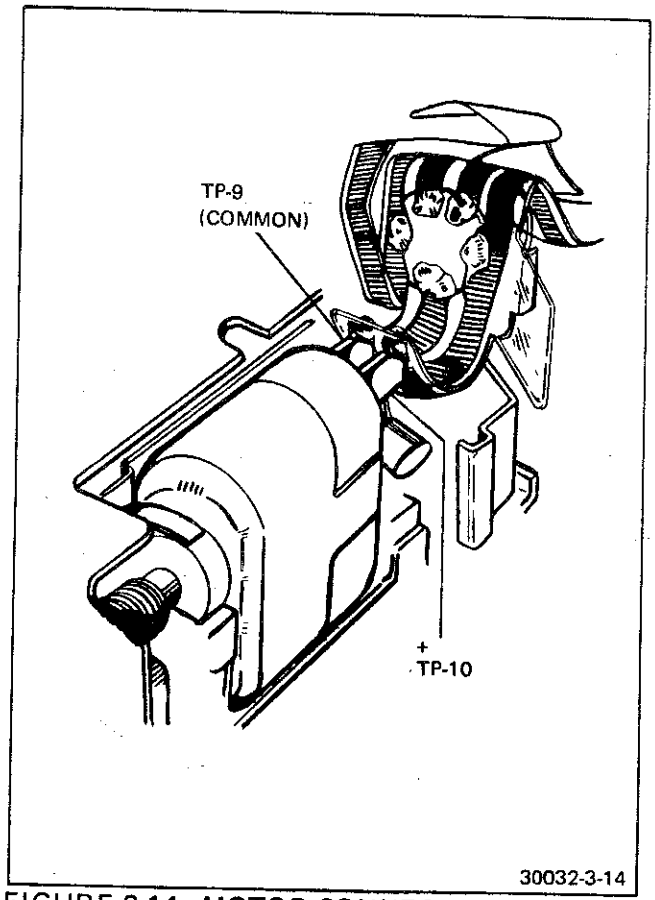


FIGURE 3-14 MOTOR CONNECTIONS

9. On the gear train rotate the second gear from the drive pinion in the counterclockwise direc-

tion (Figure 3-15). The gear train should function with no evidence of binding while driving the camera through a complete dark-slide-eject sequence. If considerable force is required to operate the gear train, remove and repair/replace the gear train. See Section IV, paragraph AA.

NOTE: Do not rotate the second gear in the clockwise direction or damage to the gears will result.

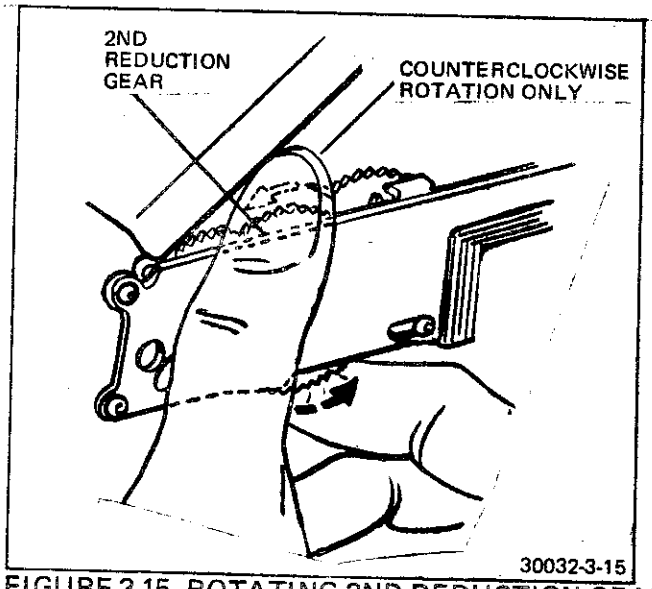


FIGURE 3-15 ROTATING 2ND REDUCTION GEAR

10. If all of the foregoing tests give no evidence of malfunction, the faulty component could be the motor capacitor (across the motor terminals). Replace the capacitor with one of known quality and repeat the test.

N. CAMERA RUNS CONTINUOUSLY

When a film pack is inserted, if the camera runs continuously, first investigate possible faults in the camera back.

1. Remove the camera bottom cover (Section IV). Connect the VOM at TP-11 (S8) (+) and TP-1 battery (–). While observing the meter, insert the power-supply adapter into the camera film compartment. The meter should indicate 5.8 volts during the first cycle but should drop to zero when the dark slide is ejected indicating that switch S8 has opened. If the switch fails to open, replace the counter assembly. See Section IV. If the switch functions as it should, proceed to check S5.

2. Switch S5 is mounted on the gear-train assembly and its contacts are accessible when the camera bottom cover is removed. S5 is the switch nearest the drive-pinion end of the gear train. Remove the power-supply simulator and remove the camera bottom cover. Check the resistance across the S5 connectors. The resistance should be zero (closed switch). While watching the recock ram, rotate the gear train by hand until the ram moves away from S5. The switch should open as indicated by an infinity reading on the VOM. If S5 does not perform in this manner, adjust or replace S5 as described in Paragraph III-S. If S5 is functioning correctly, check the flex circuit.

3. Connect the VOM across TP-3 (flex ground) (–) and TP-12 (flex-pad) (S5) and repeat the procedure described in step 2. If the correct readings (zero and infinity) are not obtained, resolder the flex circuit connections and recheck. If the correct readings are obtained, move the test leads to TP-5 (–) and TP-13 (S5) on the substrate. (See Section IV for instructions for gaining access to the substrate.) Repeat the step 2 test. If the readings (zero and infinity are not obtained, resolder the cable connections at the substrate or replace the cable if necessary. If the correct readings are obtained, check the motor control signals (drive signal and brake signal).

4. Check for a motor drive signal at the flex circuit. Set the VOM on the 1.5 VDC scale. Connect the meter to TP-3 (–) and TP-21 (+). Read the meter while the motor is running. The meter should read 0.6 volts. When the recock ram releases S5, the meter reading should drop to zero. If it does not, connect the meter to TP-5 (shutter pad) (–) and TP-30 (shutter NPN (+). If the meter readings are correct at these test points, the ribbon cable is defective. Repair/replace the cable and retest. If the correct readings are still not obtained, perform a check of the shutter.

5. Check for a brake signal (not used in Fairchild) at the flex circuit. Set the VOM at the 0.5 VDC scale. Connect the meter at TP-4 (+) and TP-22 (–). Read the meter while the motor is running. The meter needle will fluctuate slightly while the motor is running. When the recock ram releases S5, the meter should give a distinct upward deflection (the exact value is unimportant). This indicates that the brake signal is present. If it is not, perform the same check at TP-6 [shutter (+)] and TP-29 [shutter (–)]. If the meter performs correctly at these test points, the ribbon cable is defective. Repair/replace the cable and retest. If the correct readings are still not obtained, perform a check of the shutter.

6. Check for a drive signal at the MCC. Set the VOM on the 1.5 VDC scale. Connect the meter to TP-25 (MCC) (–) and TP-26 (MCC NPN) (+) (Figure 3-16). Read the meter while the motor is running. The meter should read 0.6 volts. When the recock ram releases S5, the meter reading should drop to zero. If it does not, replace the MCC.

7. Check for a brake signal at the MCC. Set the VOM on the 0.5 VDC scale. Connect the meter to TP-23 PNP (–) and TP-24 (+). Read the meter while the motor is running. The meter needle should fluctuate slightly. When the recock ram releases S5, the meter should give a distinct upward deflection (the exact value is unimportant). This indicates that the brake signal is present.

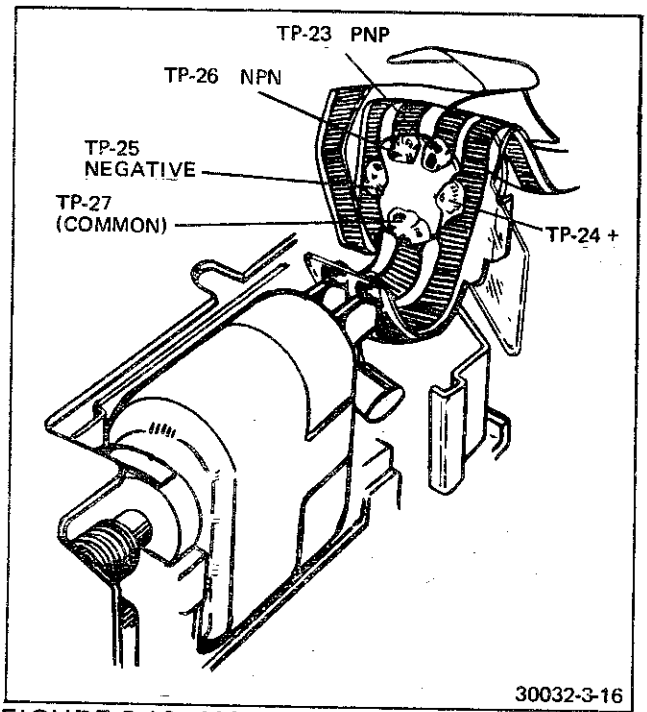


FIGURE 3-16 MCC CONNECTIONS

8. If the preceding checks have not indicated a fault, make the following discrete checks of the MCC.

9. Check for an MCC drive signal. Set the VOM on the 15 VDC scale. Connect the meter to TP-25 (–) and TP-27 (+). Read the meter while the motor is running. The reading should be approximately 0.2 VDC. When the recock ram releases S5, the meter reading should increase to approximately 5.8 volts.

10. Check for an MCC braking signal. Set the VOM on the 15 VDC scale. Connect the meter to TP-24 (+) and TP-27 (–). Read the meter while the motor is running. The meter should indicate approximately 5.6 VDC. When the recock ram releases S5, the meter needle should drop to zero. If the preceding readings are not obtained, replace the MCC.

O. CAMERA RUNS THROUGH PARTIAL SEQUENCE

If, when a film pack is inserted, the camera starts to run and then stops before completing the dark-slide-eject sequence, first identify one of two conditions. The shutter blades close and the camera stops, or the blades close and the Fresnel carrier lifts and the sequence stops. The checkout procedures are described in that order.

1. If the sequence stops as soon as the blades close, check the drive train. Remove the gear train cover to provide access to the gear train. Identify the second gear from the drive-pinion end of the gear train and attempt to rotate the gear in the counterclockwise direction (**Do not use force**). If the gear does not rotate freely, mechanical binding is evidenced. Remove, adjust, or replace the gear train as necessary. See Section IV, AA. If there is no evidence of binding, check switch S3 as follows:

2. With the VOM set for low-ohm's scale, connect the meter across switch S3 (mounted on the gear-train outer plate) TP-14 (–) and TP-15 (+). Observe the meter while manually running the camera by means of the second gear in the gear train. At the start of the sequence, the switch should be closed (zero ohms). When the switch is contacted by the recock ram, the switch should open (infinity on the ohmmeter). If switch S3 fails to produce these indications, adjust and/or replace the switch (Paragraph III-S) Z4. If switch S3 is functioning correctly, check S4.

3. Switch S4 can only be checked by the adjust-check-readjust-recheck method. Remove the focus wheel (Section IV) AE, to gain access to the solenoid plunger.

4. Connect the VOM (in the low-ohms range) TP-16 (S4B) and TP-18 (S4C). Using a small jeweler's screwdriver, manually seat the solenoid plunger (Figure 3-17). The meter should indicate zero (continuity). Repeat the check at TP-8 Sol 1 S4C and TP-31 (S4B).

5. If the switch does not produce the foregoing results, use needle-nose pliers and tilt the pin

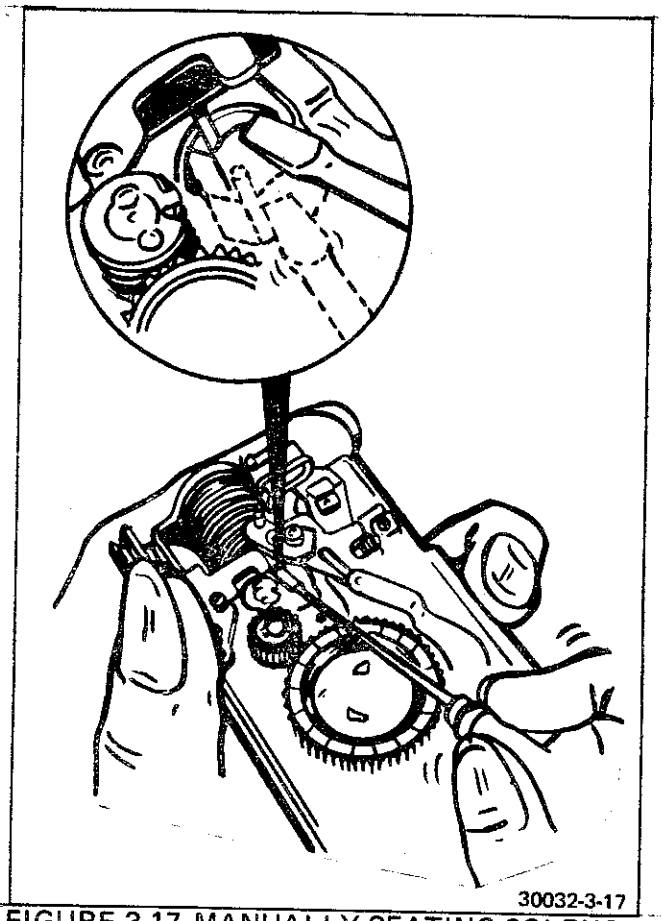


FIGURE 3-17 MANUALLY SEATING SOLENOID 1 PLUNGER

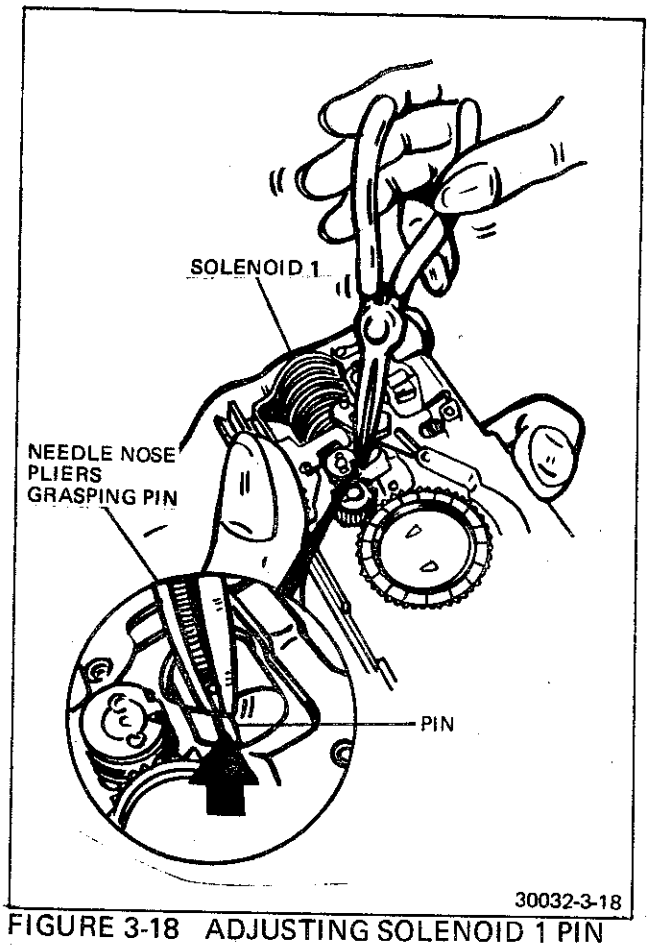


FIGURE 3-18 ADJUSTING SOLENOID 1 PIN

very slightly in the direction of the lens (Figure 3-18). Repeat step 4 and step 5 as necessary to correct the S4 malfunction. If the switch cannot be made to perform correctly, replace the S4 switch and/or blade drive assembly. If the switch performs correctly, proceed to check the motor control circuits (MCC).

6. Use the Triplett Model 801 VOM. Set the meter on the low-ohms scale. Check the resistance between TP-5 and TP-21 (NPN). The meter should indicate 50 ohms and the motor should run if the film pack is inserted. In this test, the VOM supplies the motor run signal and measures the resistance.

7. If the motor runs under these conditions, check for a run signal. Set the VOM on the 15 VDC scale. Connect the meter to TP-25 (–) and TP-27 (+). Read the meter while the motor is running. The reading should be approximately 0.2 VDC. When the recock ram releases S5, the meter reading should increase to approximately 5.8 volts. If this run signal is present, the camera should run. If there is no run signal, the only remedy is to replace the substrate.

8. If the MCC check (step 6) produced no results, check the motor individually. Connect a jumper wire between TP-25 and TP-27. This should cause the motor to run. If it does run, it indicates that the fault is elsewhere. Examine the flex circuit connections between the MCC and the motor (Figure 3-19). If in doubt, resolder the connections. If this does not solve the problem, perform a discrete check of the MCC.

9. Use the Triplett Model 801 VOM set at the low-ohms scale. Check the resistance between test point 25 and test point 27. The resistance should be approximately fifty ohms. If the resistance is not correct, replace the MCC.

10. The alternate possible malfunction results in the following partial sequence. The shutter blades close, the Fresnel carrier lifts, and the sequence stops. When this occurs, first check the performance of switch S3.

11. With the VOM set for low-ohms scale, connect the meter across S3 (mounted on the gear-train outer plate) TP-14 (S3) and TP-15 (S3). Observe the meter while manually running the camera by means of the second gear in the

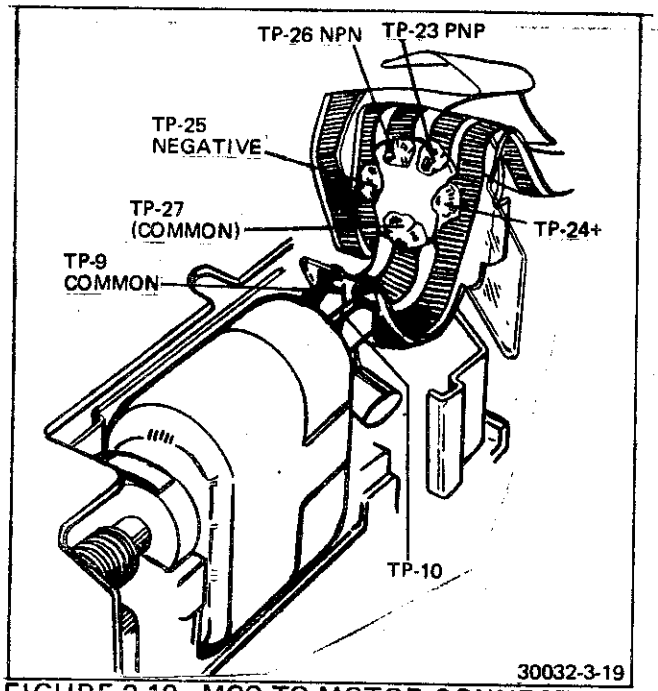


FIGURE 3-19 MCC TO MOTOR CONNECTIONS

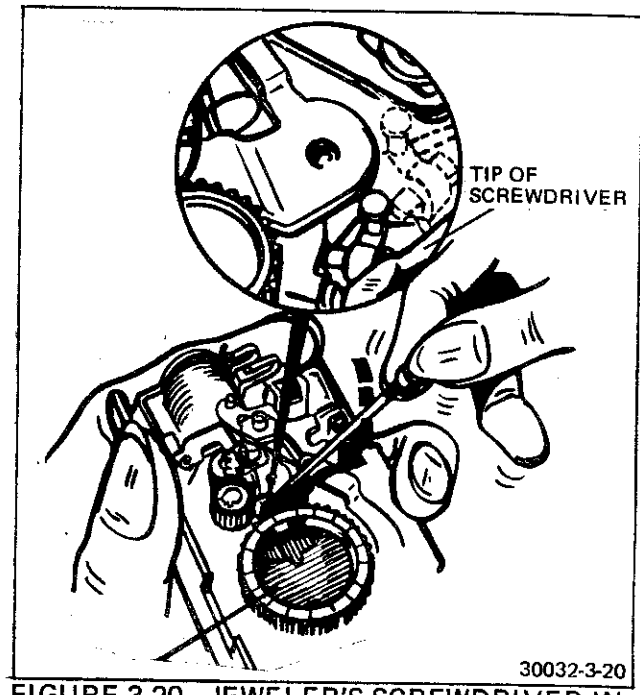


FIGURE 3-20 JEWELER'S SCREWDRIVER IN WALKING BEAM

gear train. At the start of the sequence, the switch should be closed (zero ohms). When the switch is contacted by the recock ram, the switch should open (infinity on the ohmmeter). If switch S3 fails to produce these indications adjust and/or replace the switch (Paragraph III-S). If correct readings are obtained, repeat the checks at TP-3 (flex pad) and TP-32 (S3).

12. If the foregoing tests indicate no fault, carefully examine the flex circuit and connections for possible short circuits. If none are found, check for the S3 signal on the substrate.

13. Connect the VOM (on the low-ohms scale) at TP-5 and TP-28 (S3). Repeat step 5. If fault still indicated, replace substrate.

P. SHUTTER BLADES CHATTER

If, when a film pack is inserted, the shutter blades chatter, the component most suspect is solenoid no. 1. Because it is actuated by solenoid no. 1, the S4 switch can also be at fault. The malfunction is the result of switch S4 changing the solenoid drive voltage to the power-down value before the solenoid plunger has travelled far enough to function with the reduced voltage. Perform the following checks:

1. Remove the shutter housing (See Section IV) to gain access to the solenoid mechanism.

2. Use a jeweler's screwdriver and manually actuate the walking beam assembly (Figure 3-20) to determine that the assembly moves freely through its complete travel (shutter blades totally closed). If there is any indication of binding, remove and repair/replace the assembly.

3. If the solenoid appears to be free of any mechanical problems, the malfunction is probably caused by a faulty or misadjusted S4 switch. The switch itself cannot be adjusted without performing a major shutter disassembly. The desired results can be obtained by slightly bending the pin in the solenoid plunger. Assuming the shutter-blade chatter is a result of the S4 switch being actuated prematurely, proceed as follows:

4. Remove the focus wheel to gain access to the solenoid plunger.

5. Use needle-nose pliers and tilt the pin very slightly in the direction of the lens. Recheck the camera and repeat the adjustment as necessary.

6. If the foregoing adjustments fail to correct the malfunction, it will be necessary to replace the blade drive assembly as described in Section IV (paragraph AG. Install the replacement and recheck the camera.

Q. EXPOSURE CYCLE CHECK

When the camera correctly performs a complete dark-slide-eject sequence, the exposure sequence

can be checked. Fault Analysis Chart No. 2 graphically presents the checkout process. With a film pack (or power-supply adapter installed in the film compartment, and the dark-slide-eject sequence completed) press the exposure button (S1). The motor should run, the shutter blades should close, the Fresnel carrier should lift, the shutter blades should open and close, the Fresnel carrier should drop, the film should eject and the shutter blades should open. There are three possible variations of malfunction. The camera functions as described, the camera does not operate, or the camera starts to run but does not complete the exposure cycle. If the camera functions correctly, proceed to the exposure test, Fault Analysis Chart No. 3.

1. If the camera fails to operate, first install a remote shutter release (Figure 3-21) in the remote connector. Operate the remote release. If this causes the camera to function correctly, a faulty S1 switch is indicated.

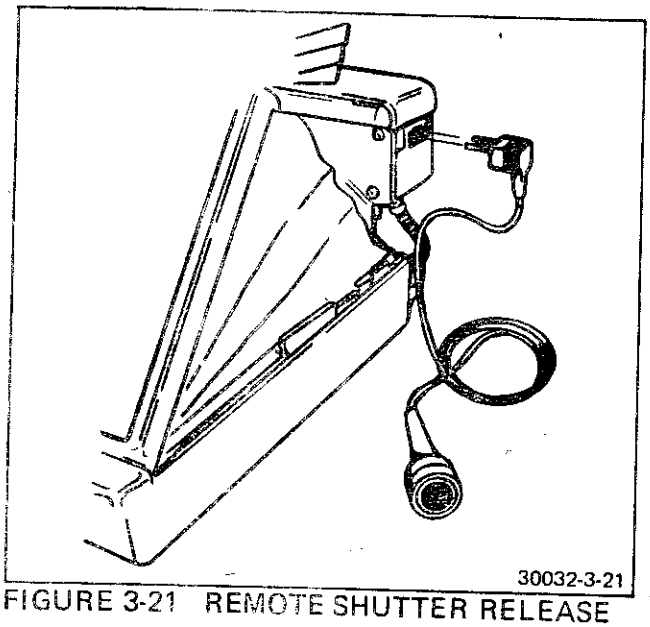


FIGURE 3-21 REMOTE SHUTTER RELEASE

2. Follow the procedures in Section IV, paragraph AE, and remove the shutter from the shutter mounting hinge bracket. With the VOM set at the low-ohms scale, connect the meter to TP-19 (+) and TP-20 (–). The meter should indicate infinity (open circuit). Press the exposure button. The meter should indicate zero (closed circuit). If it does not, remove the shutter housing and perform the same test with the ohmmeter connected to the two terminals on the rear surface of the exposure button. If the button is defective, replace the shutter housing as described in Section IV. If the button operates correctly, clean the two contact points on the shutter. Spring the contacts forward a small amount (Figure 3-22), reinstall the housing and recheck.

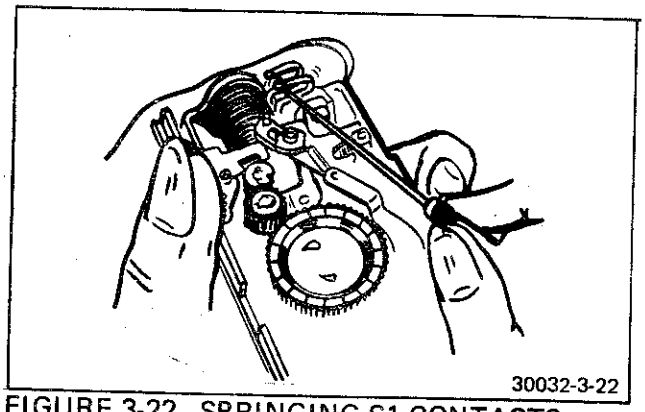


FIGURE 3-22 SPRINGING S1 CONTACTS

3. If the camera failed to function when the remote release was operated, remove the shutter assembly from the hinge bracket and check the solder connections at TP-19 and TP-20. Resolder if necessary.

4. If the camera runs through a partial exposure cycle, first check for unwanted electrical interference (noise) from the motor.

5. If there is no evidence of motor noise, check the gear train for binding. If there is evidence of binding, remove and repair gear train. See Section IV, paragraph AA.

R. PHOTOCELL FILTER AND SHUTTER TRACKING TESTS

If the camera is overexposing, the fault may be corrected by changing the photocell filter, correcting the shutter tracking or both. It is first necessary to identify the possible correction.

1. Remove the photocell bezel and filter. See Section IV, page 4-78, AF-17.

2. Install the camera on the Comprehensive Test Set and perform the ambient mode exposure test described in paragraph I.

3. If the reading obtained without the filter is greater than specification, a filter change will not correct the malfunction and the shutter must be replaced.

4. If the exposure reading is between +0.2 and –0.1, the camera will produce correct exposures with no photocell filter but a filter must always be in place since the photocell opening

must not be left unprotected. Install the lightest filter T.I. part no. 706294 or Fairchild 706894 (least density) and retest the camera. If the exposure readings are still between +0.2 and -0.1, the overexposure problem has been resolved.

5. If the exposure reading obtained in step 4 was less than −0.1, remove the camera from the tester and install a filter with a stop value most nearly equal to the meter reading. Retest the camera. An exposure meter reading of zero indicates a perfect exposure, however, refer to page 3-44, specification table, for range.

6. If the camera malfunction is underexposure, all of the procedures in this section can be applied to locate the fault.

7. If the camera produces an extremely long exposure and has passed initial tests, visually examine the photocell optical path. If any obstruction is found, clean the optical path with lens cleaner and retest.

8. If the photocell optical path is clear and the camera still produces an extremely long exposure, the substrate is faulty. Replace the shutter. See Section IV, page 4-15.

S. SWITCHES S3 AND S5 CHECK AND ADJUST

Switches S3 and S5 are mounted on the outer plate of the gear train assembly and are operated by the recock ram. Correct adjustment of the two switches is vital to proper sequencing of the electrical commands to the substrate (the computer circuits of the camera). The outer plate is slotted to permit the switches to be moved as necessary. Correct positioning of the two switches is accomplished by use of the S3/S5 adjusting fixture, Special Tool #336073 (Figure 3-23).

1. Remove the front cover, the bottom cover, and the gear-train cover.

2. On the test set, swing out the handle of the contact assembly.

3. Make sure that both left and right handles are retracted to their limits.

4. Slide the camera onto the horn of the test jig as far as it will go. Engage right and left side fixture handles in the camera.

5. Swing the indicator lamp assembly almost into position.

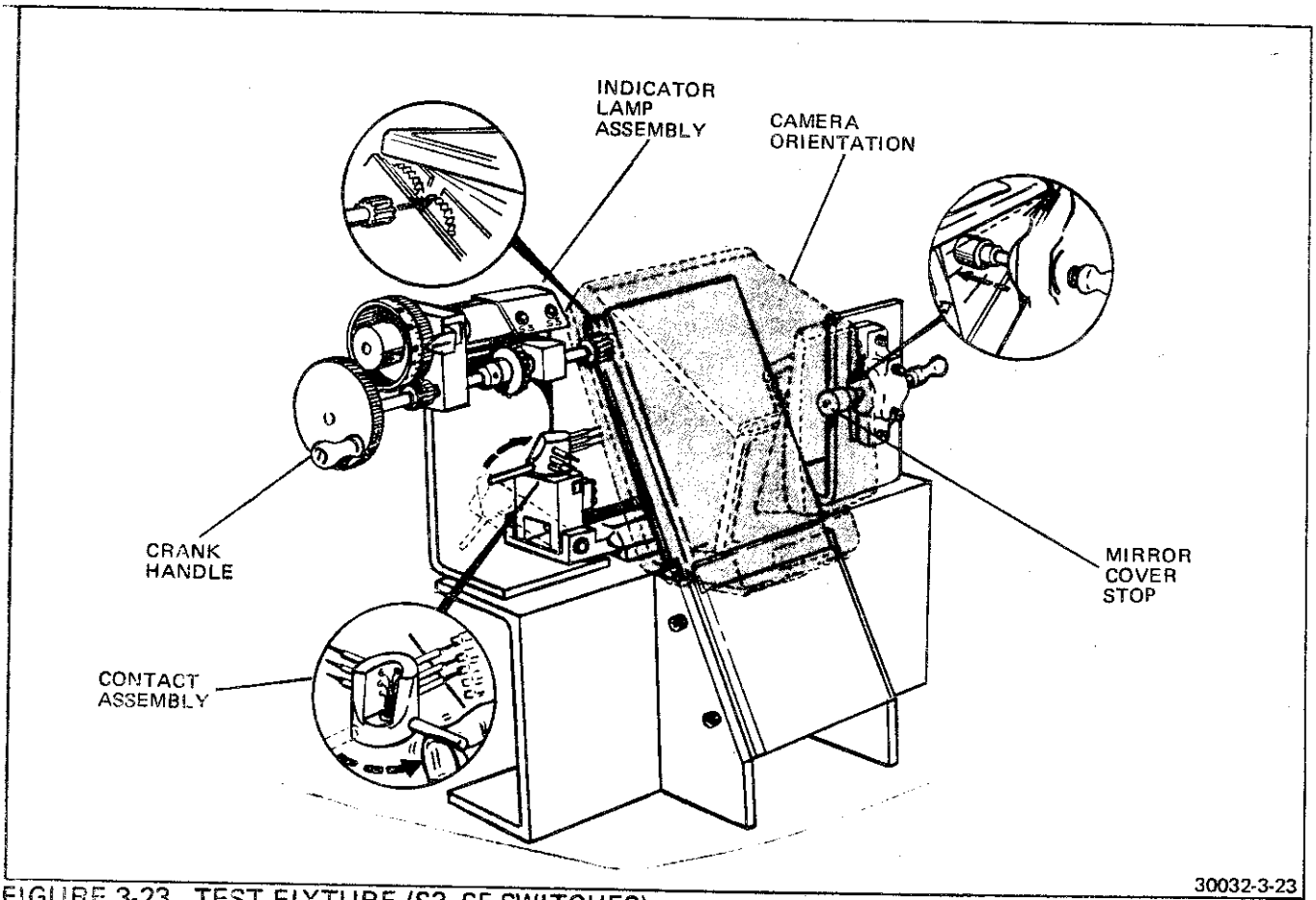


FIGURE 3-23 TEST FIXTURE (S3, S5 SWITCHES)

6. Both indicator lamps should light just before the pins contact the flex circuit pads. This indicates that the power supply is on. If the camera is in the rest position, the lamps will go out when the pins make contact. Check S3/S5 contact operation – make and break should turn lights off and on.

7. Because of the ratchet action, the hand crank will only rotate in one direction. Rotate the crank and drive the gear train through a complete operating sequence so that the recock ram makes positive contact with S5. If the S5 lamp is still on, loosen the locking screw and slide S5 to its forward limit. If the lamp is still on, replace S5 and recock.

8. If S3 lamp is on, examine the contacts of the indicator lamp assembly to insure that they make good connection with the switch contacts. If the connections are satisfactory but the lamp is still on, replace switch S3, and recheck.

9. When both lamps are off, watch the recock ram and rotate the hand crank. After a few turns the recock ram should move away from S5. This will allow S5 to open and, as a result, turn on the S5 lamp.

10. Continue rotating the hand crank until the Fresnel carrier snaps up to picture-taking position. At that point in the sequence, the ram makes contact with S3 and opens the switch. The S3 indicator lamp should go on.

11. Release the camera erecting link. Slide the right side knob inward so that the bottom edge of the mirror cover rests on the mirror cover stop on the end of the shaft.

12. While observing the S3 indicator lamp, move the mirror cover from the stop to just before the erecting link snaps in place. The lamp should go on and off with each up and down motion. This action swings the Fresnel carrier through the angle at which switch action must occur.

13. If the lamp remains off, adjust S3 by loosening the locking screw and sliding the switch toward the rear of the camera. Recheck and readjust as necessary.

14. If the lamp remains on, adjust S3 toward the front of the camera. Recheck and readjust as necessary.

NOTE: During the S3 adjustments, the S5 indicator lamp should remain off.

15. When S3 has been correctly adjusted, retract the stop and lock the erecting link.

16. Rotate the crank, driving the gear train through a complete cycle observing pick action, S5 make (light off), and S5 break (light on). Return the gear train to its starting position (recock ram making positive contact with S5).

17. Start the operating sequence again by turning the crank. When the S5 light goes off, stop cranking. Set circular counter to zero.

18. While resuming the crank rotation slowly, note the number on the counter from S5 light off to S5 light on. The number shall be between 51 and 69. If the number is less than 51, move the S5 switch towards the front. If it is more than 69, move the S5 switch to the rear of the camera. Adjust and recheck as necessary.

19. Return the camera to its starting sequence. (Pick return.)

T. LIGHT-LEAK TESTS

Caution: When using the light-leak tester, always hold the fixture so the camera is in the uppermost position (Figure 3-24). There is no latching device on the fixture and the camera could slide off if the fixture were pointed down.

The light-leak test consists of two checks: the static test (with the camera in the mirror-down or viewing position) and the dynamic test (with the camera in the mirror-up or picture-taking position). Both of these tests must be done in a darkened area. Complete them in the following manner.

1. Static Tests

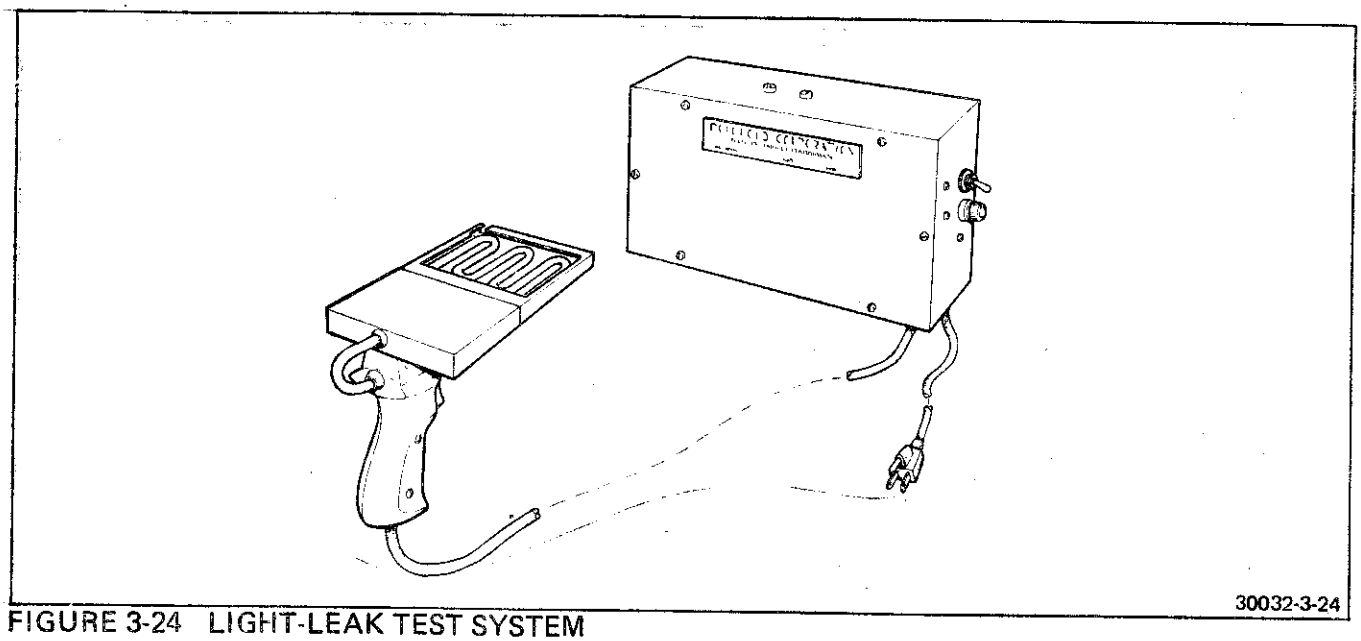
a. Erect the camera and remove the front cover assembly. Close S7.

b. Turn on the power supply and insert the light-leak fixture into the camera film compartment. The camera should run through the dark-slide-eject cycle.

c. Darken room.

d. Press and hold the fixture trigger.

e. Examine the camera from all angles, looking for light-leaks. Note the location of any light-leaks and continue below with the dynamic test.



30032-3-24

FIGURE 3-24 LIGHT-LEAK TEST SYSTEM

2. Dynamic Tests

a. Cover the camera lens and trip the shutter. With the lens covered, the mirror should stay in the raised (picture-taking) position long enough to perform the dynamic light-leak test, approximately 20 seconds.

b. Press and hold the fixture trigger.

c. Examine the camera for light-leaks. Gently flex the boot while looking for leaks. Note the location of any light-leaks. Allow camera cycle completion. Remove fixture.

d. Turn off the power.

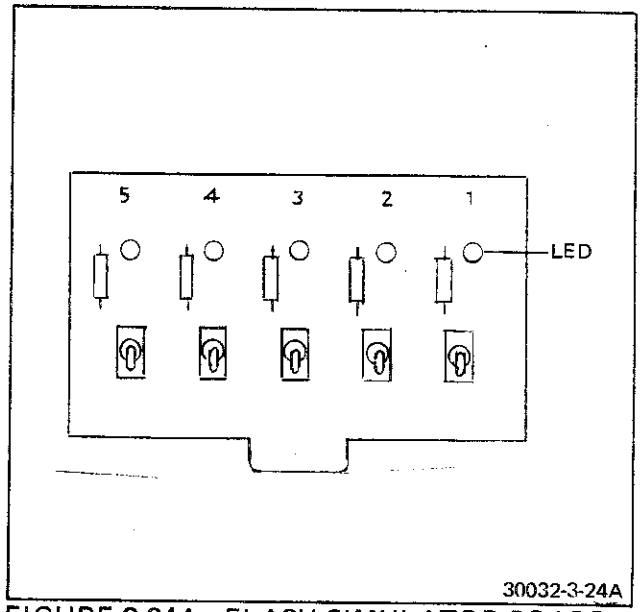
e. Repair any light-leaks noted in the previous testing. If light-leak repairs are made, retest the camera.

3. Flash Firing Test

A quick and easy method of checking the flash firing capability of the SX-70 camera is now available. The drawing shows the Flash Simulator Board, containing 5 light emitting diodes (LED's), 5 resistors and 5 toggle switches (Special Tool #11821).

The method of use is:

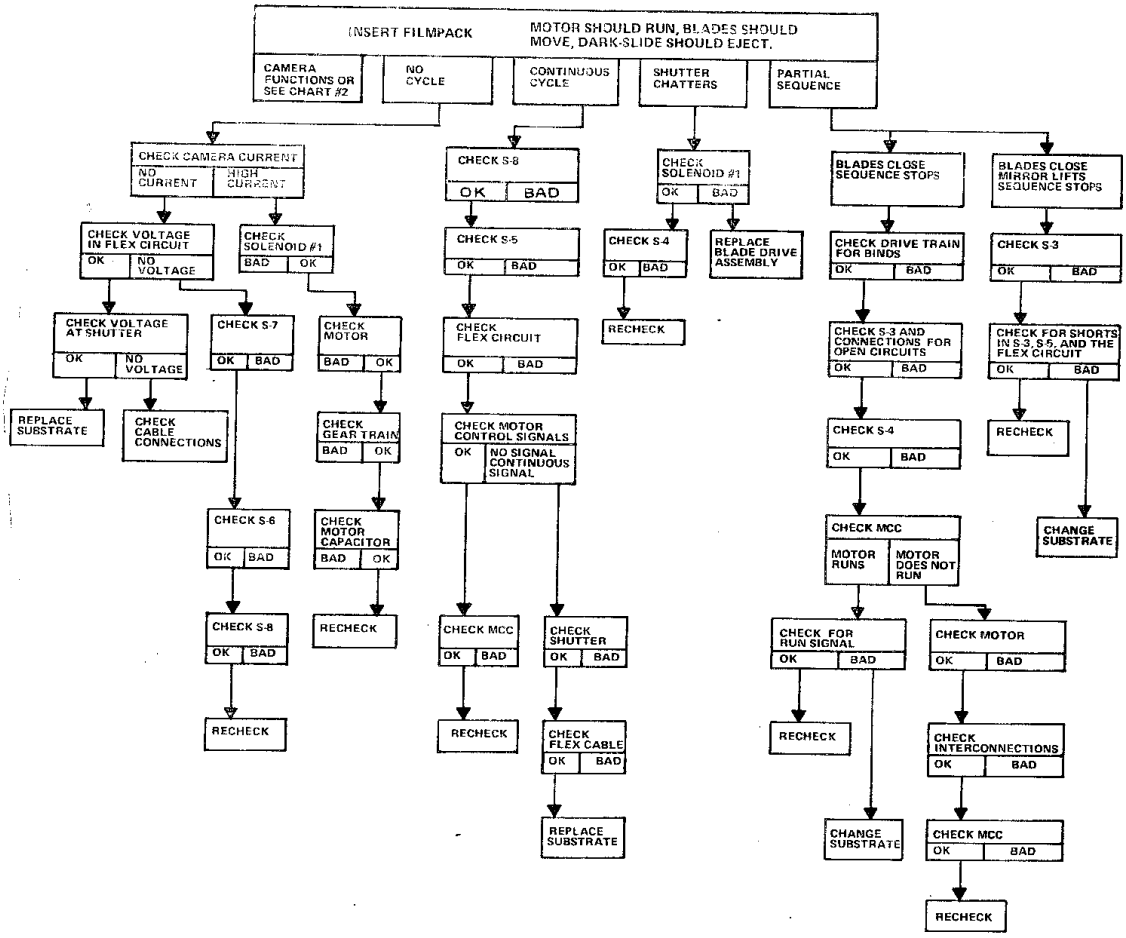
1. Insure that all switches are in the position shown - down.
2. Insert a film pack or film pack simulator into the camera.
3. Install the flash simulator board into the camera flashbar socket in the same way as a flashbar would be installed.
4. Press the red exposure button, S-1.



30032-3-24A

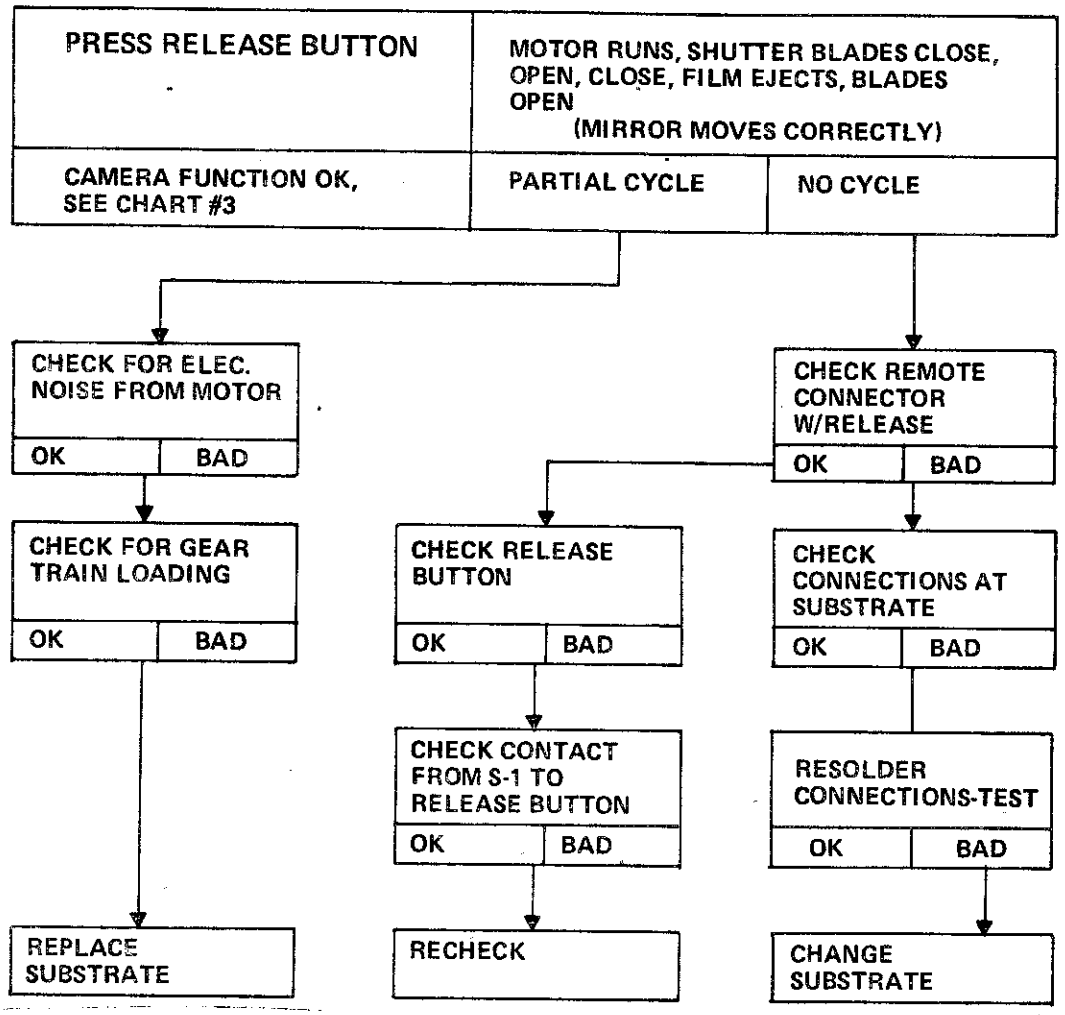
FIGURE 3-24A FLASH SIMULATOR BOARD

5. Observe that LED #1 flashes.
6. Throw switch S-1 up.
7. Press the red exposure button.
8. Observe that LED #2 flashes.
9. Throw switch S-2 up.
10. In like manner, continue pressing the red exposure button and throwing the corresponding switches up until all 5 lights have flashed.
11. Repeat steps 4 through 10. The lights should flash 5 more times.
12. Press S-1.
13. Observe that no light flashes. This confirms proper operation of S-9.

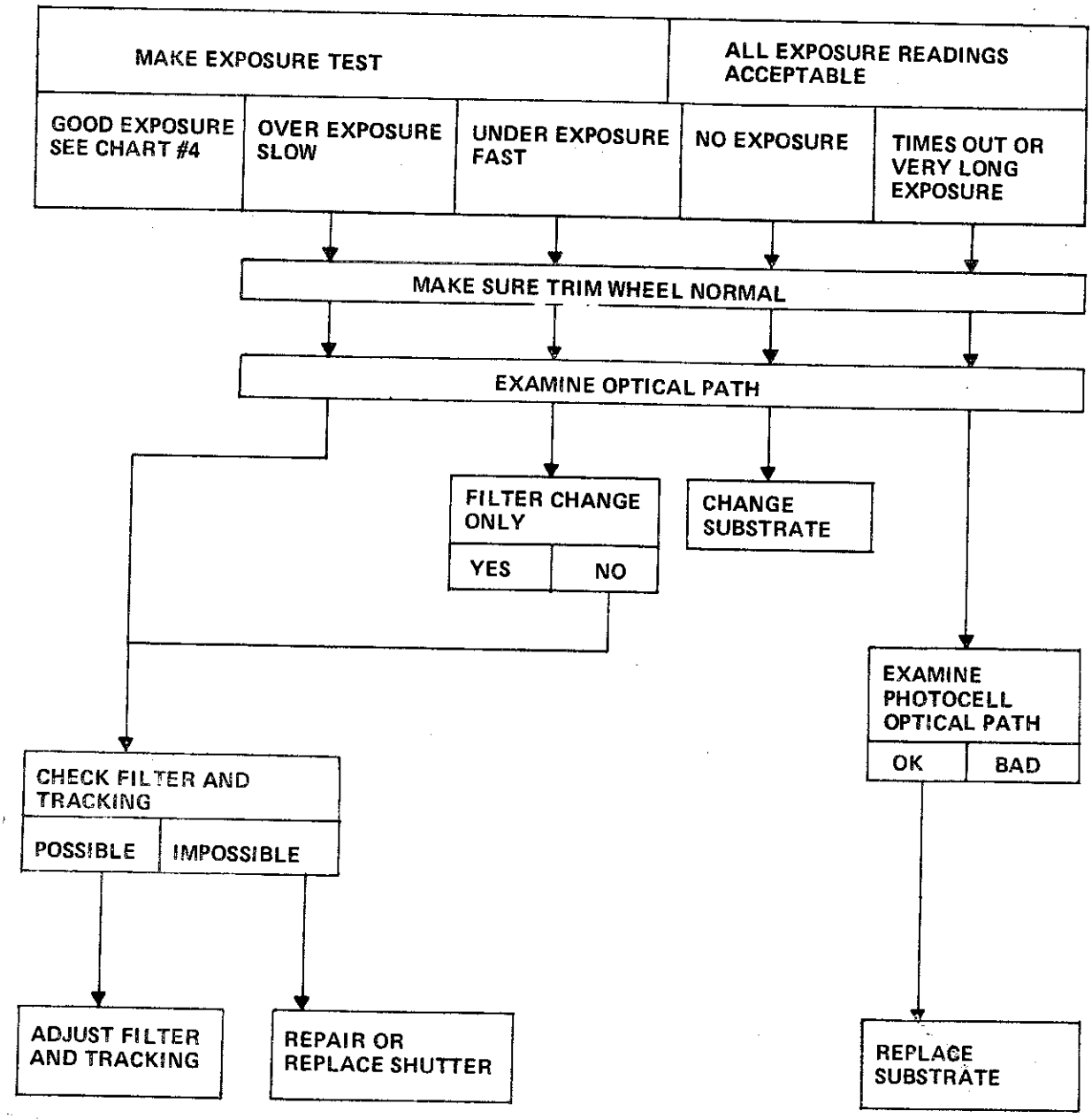


FAULT ANALYSIS CHART NO. 1
DARK-SLIDE-EJECT FUNCTION

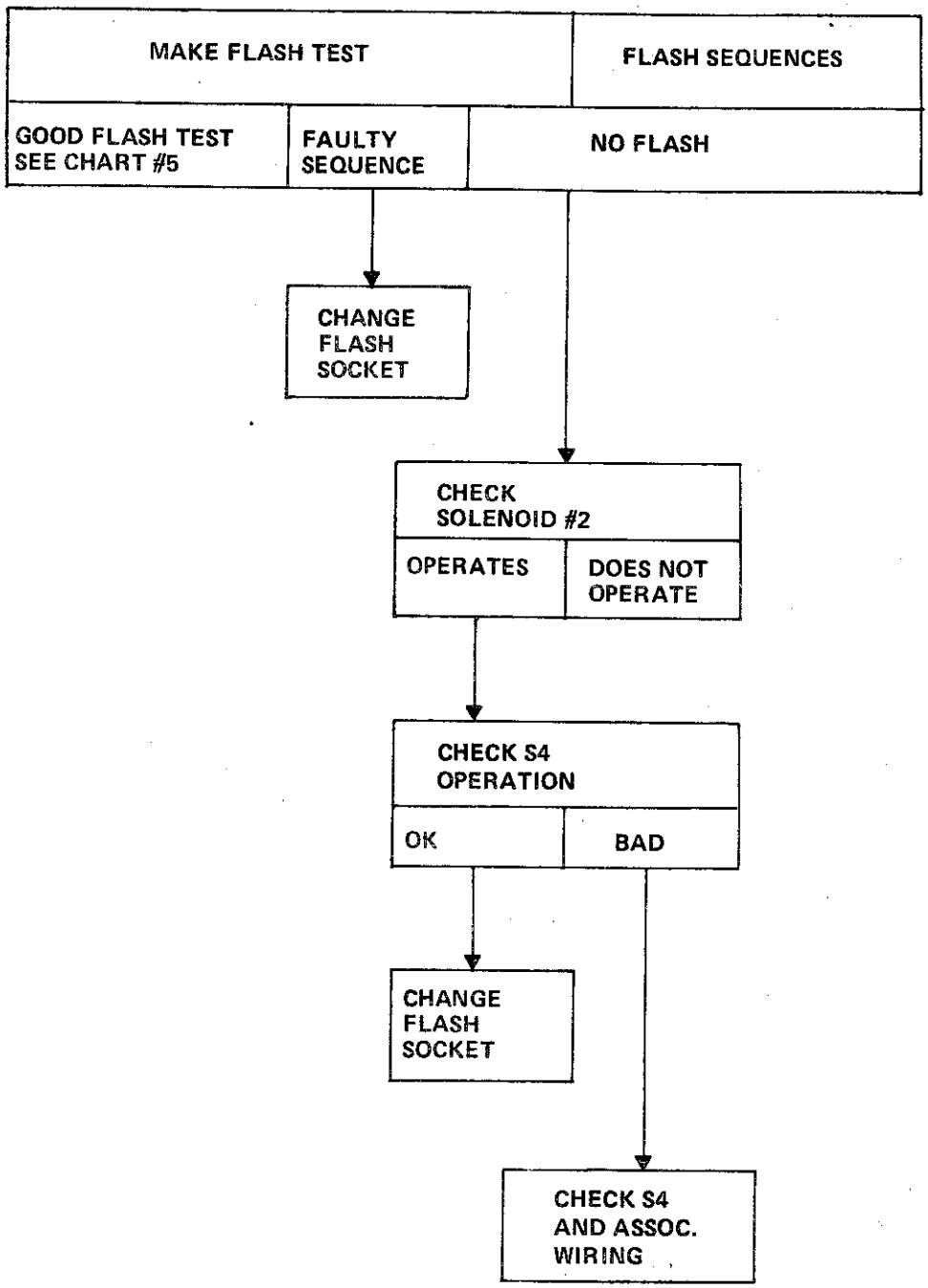
FAULT ANALYSIS CHART NO. 2
EXPOSURE FUNCTION



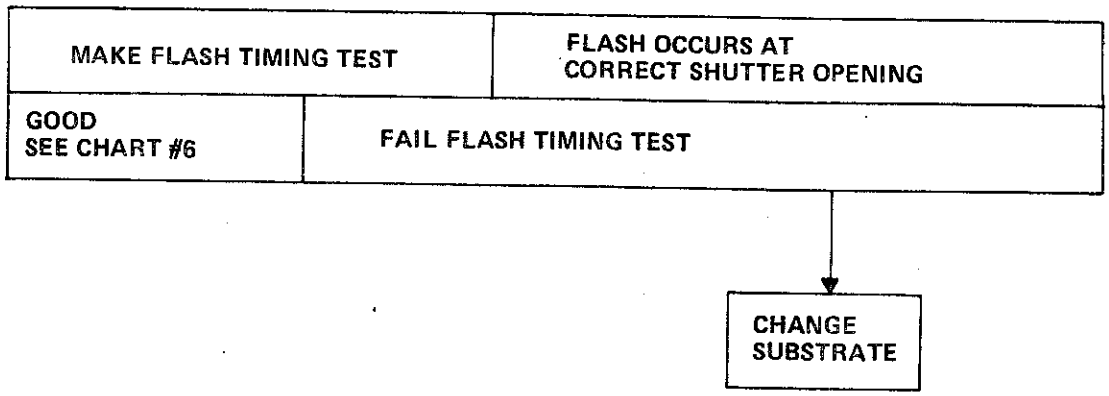
FAULT ANALYSIS CHART NO. 3
EXPOSURE FUNCTION



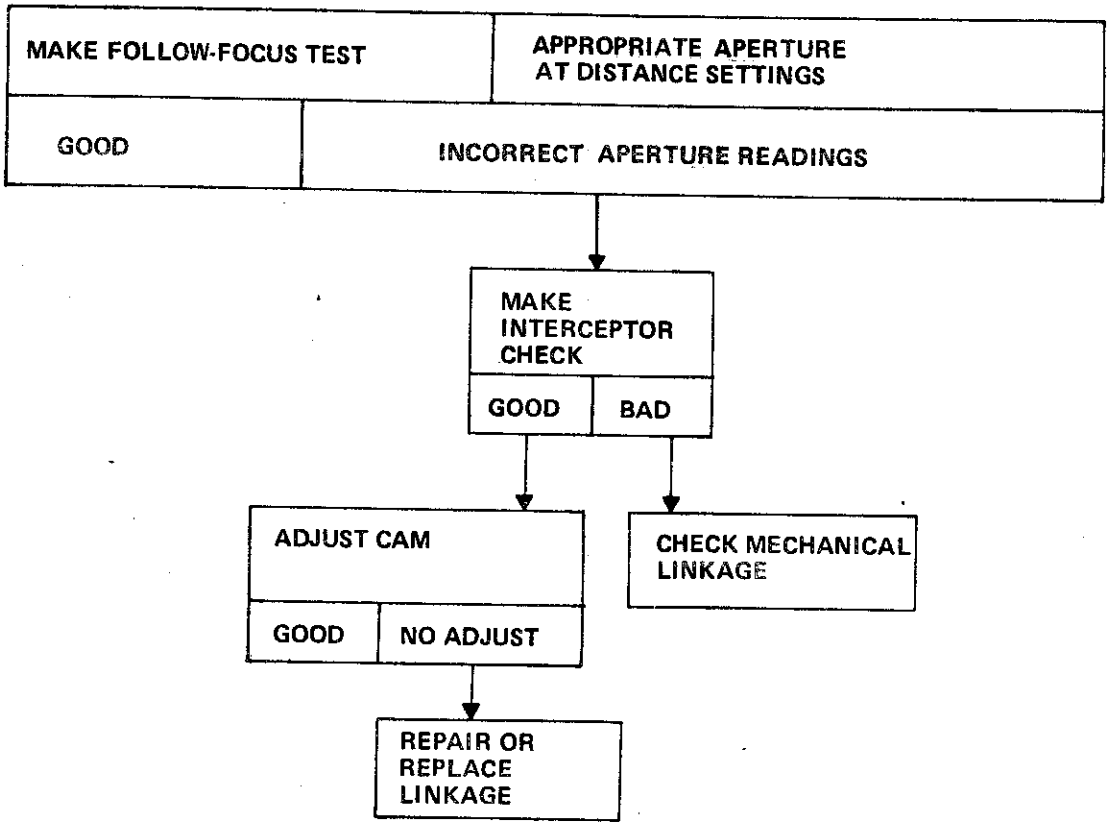
FAULT ANALYSIS CHART NO. 4
FLASH FUNCTION



FAULT ANALYSIS CHART NO. 5
FLASH TIMING


MAKE FLASH TIMING TEST
FLASH OCCURS AT CORRECT SHUTTER OPENING
GOOD SEE CHART #6
FAIL FLASH TIMING TEST
CHANGE SUBSTRATE

FAULT ANALYSIS CHART NO. 6
FOLLOW-FOCUS FUNCTION



U. SHUTTER CHECKOUT PROCEDURES

1. On the Camera

The following logic flow failure analysis charts are included here for completeness. The charts previously referenced and integrated in the text may be used as directed. If, however, more detailed analysis is desirable, use this information. To perform the tests see Figure 3-25 and connect the units as shown. The film pack simulator is inserted in the camera and the negative lead from the VOM is connected to camera ground through the power supply allowing all the tests to be accomplished simply by moving the positive VOM lead as a probe from point to point. See Figures 3-26 and 3-27 for location of test points.

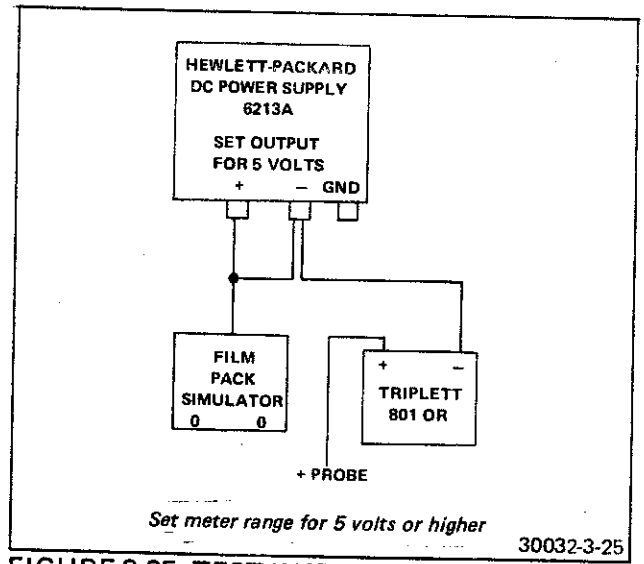


FIGURE 3-25 TEST INSTRUMENT CONNECTIONS

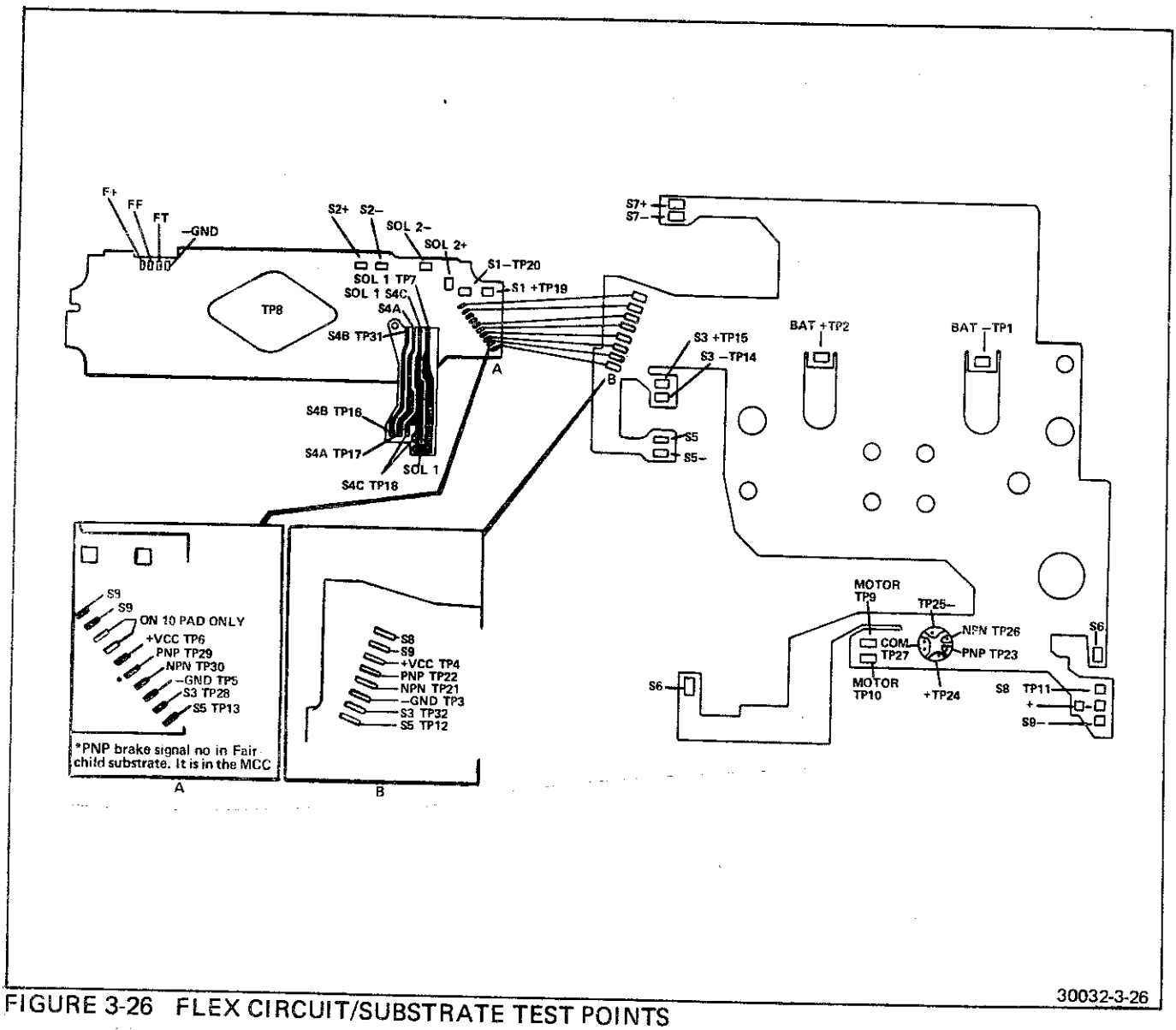
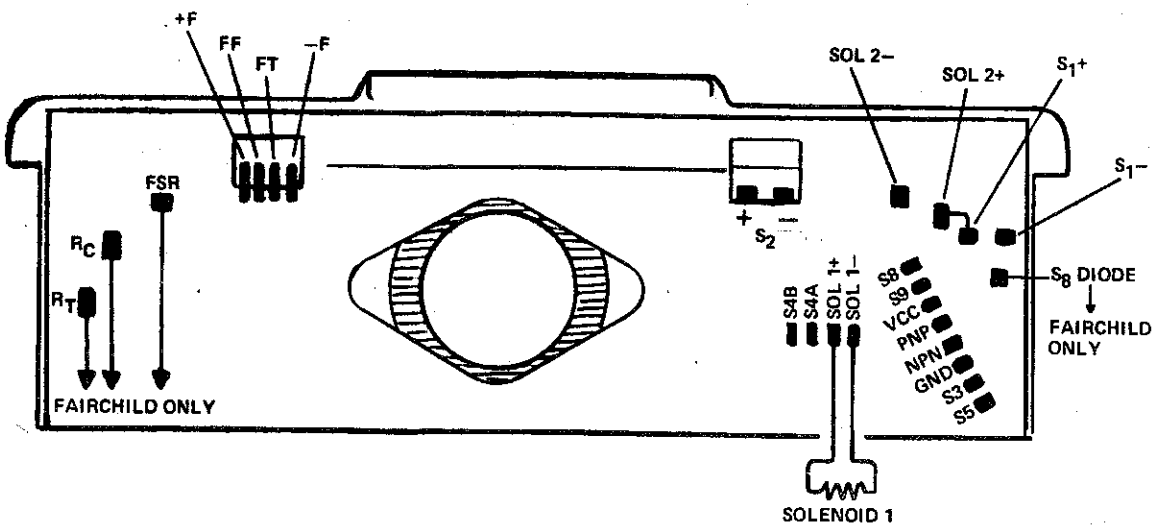


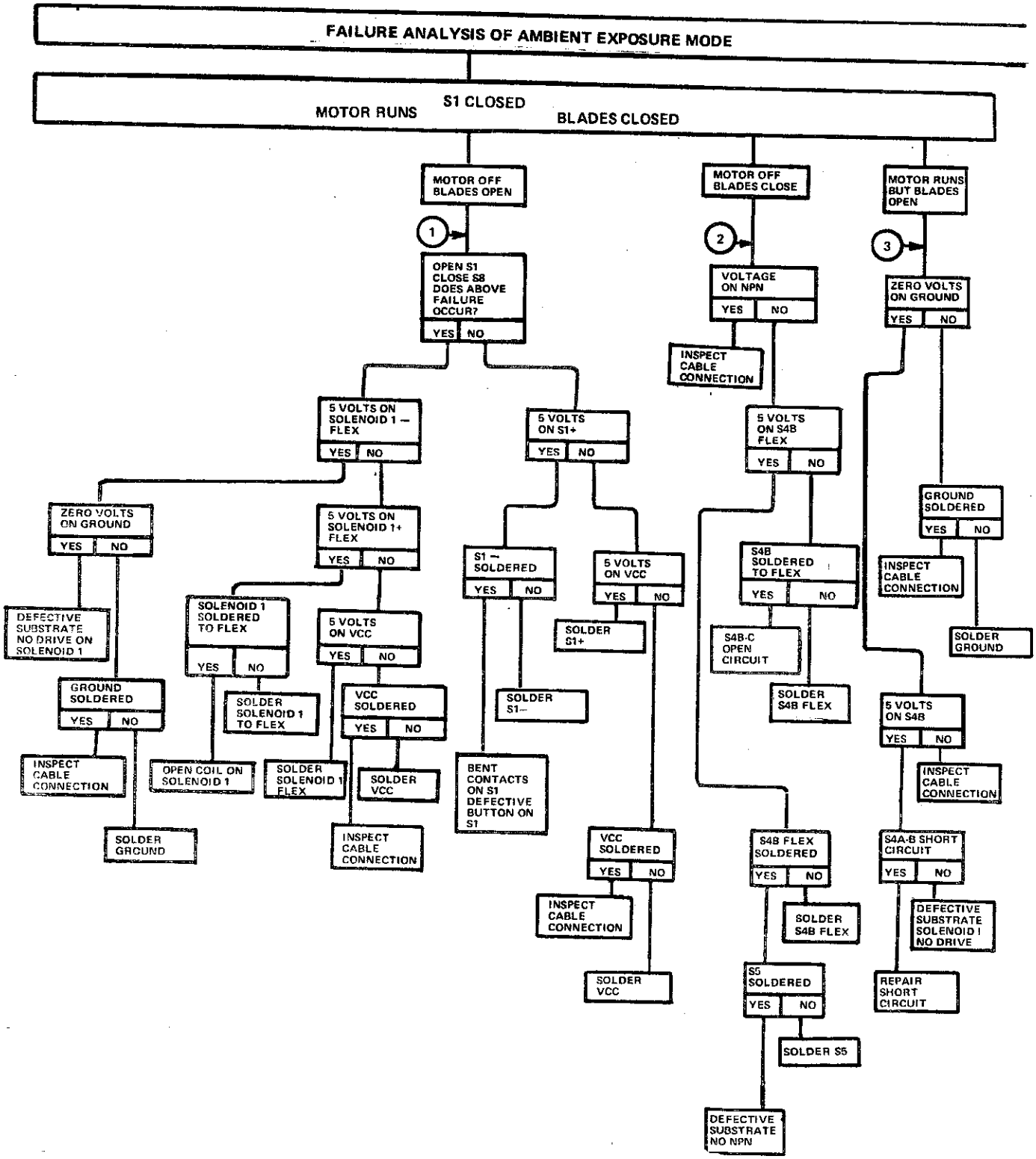
FIGURE 3-26 FLEX CIRCUIT/SUBSTRATE TEST POINTS

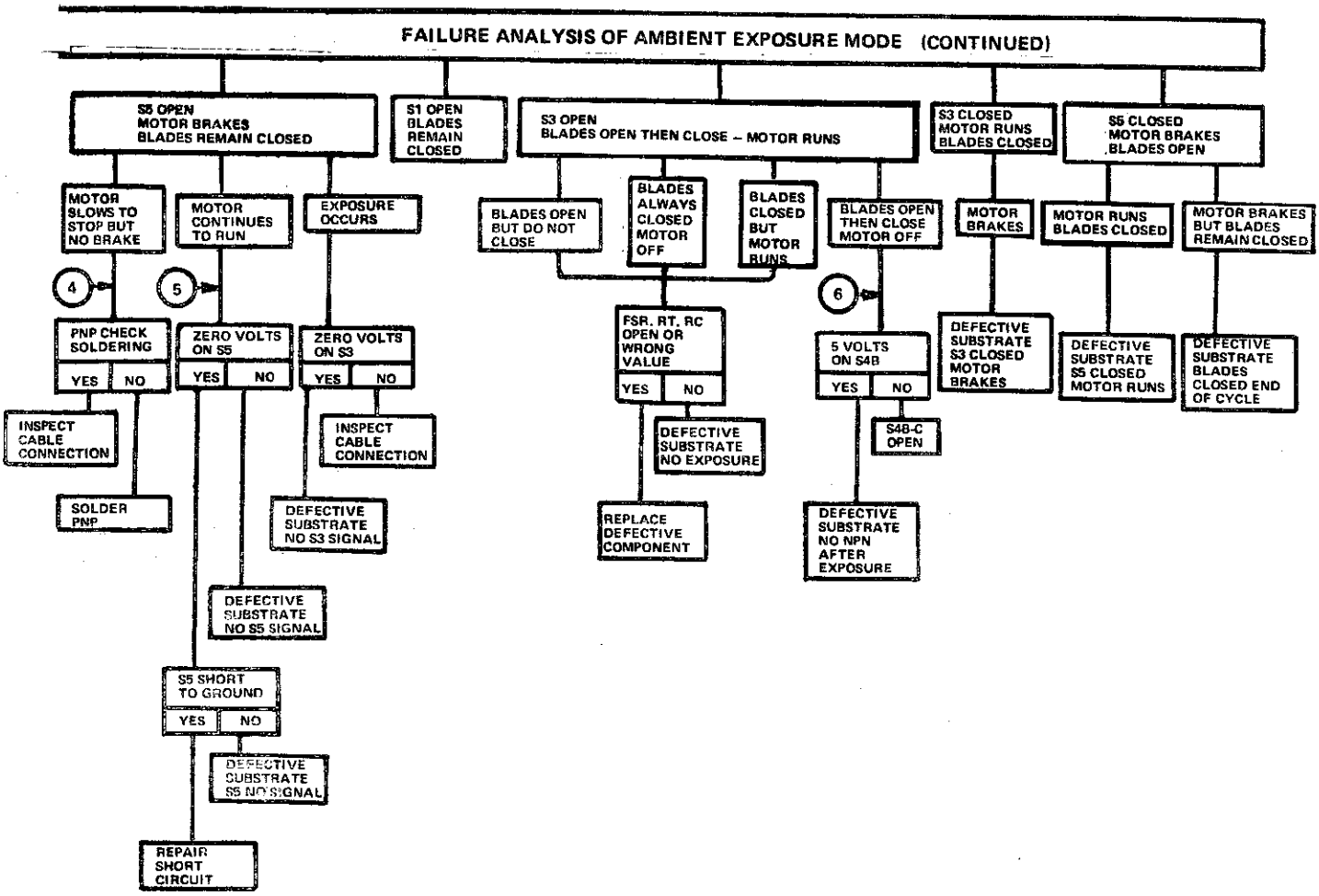


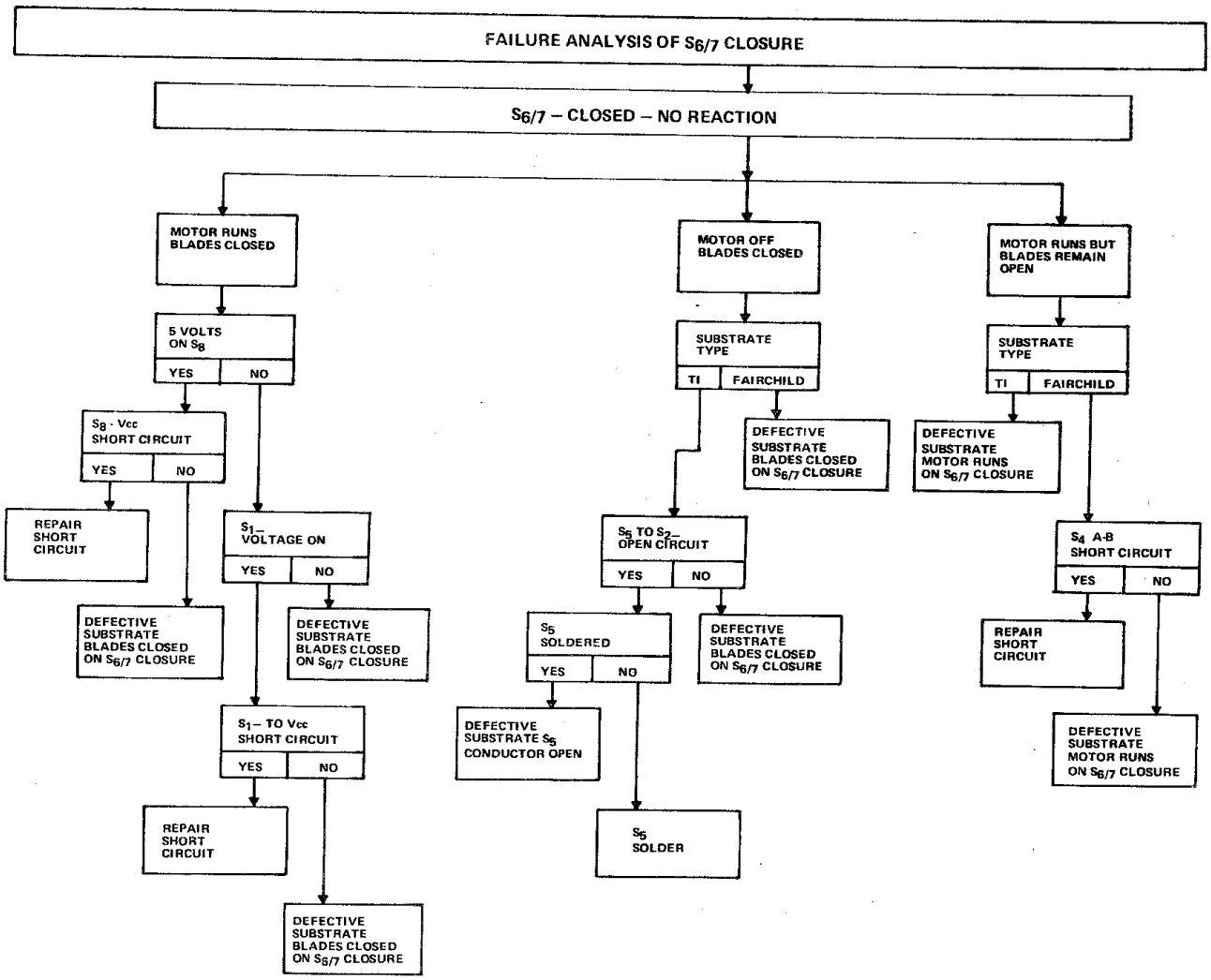
SX-70 Shutter Test Points – to be used in conjunction with failure analysis tree

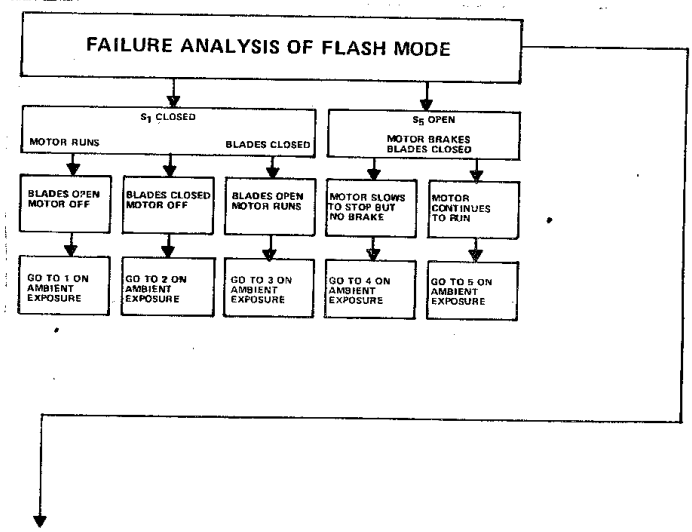
30032-3-27

FIGURE 3-27 SHUTTER TEST POINTS


FAILURE ANALYSIS OF AMBIENT EXPOSURE MODE
MOTOR RUNS
S1 CLOSED
BLADES CLOSED
MOTOR OFF BLADES OPEN
MOTOR OFF BLADES CLOSE
MOTOR RUNS BUT BLADES OPEN
1
2
3
OPEN S1 CLOSE S8 DOES ABOVE FAILURE OCCUR?
YES NO
VOLTAGE ON NPN
YES NO
INSPECT CABLE CONNECTION
ZERO VOLTS ON GROUND
YES NO
5 VOLTS ON SOLENOID 1 – FLEX
YES NO
5 VOLTS ON S1+
YES NO
5 VOLTS ON S4B FLEX
YES NO
ZERO VOLTS ON GROUND
YES NO
DEFECTIVE SUBSTRATE NO DRIVE ON SOLENOID 1
GROUND SOLDERED
YES NO
INSPECT CABLE CONNECTION
SOLDER GROUND
5 VOLTS ON SOLENOID 1+ FLEX
YES NO
SOLENOID 1 SOLDERED TO FLEX
YES NO
OPEN COIL ON SOLENOID 1
SOLDER SOLENOID 1 TO FLEX
5 VOLTS ON VCC
YES NO
SOLDER SOLENOID 1 FLEX
VCC SOLDERED
YES NO
SOLDER VCC
INSPECT CABLE CONNECTION
S1 – SOLDERED
YES NO
SOLDER S1–
BENT CONTACTS ON S1 DEFECTIVE BUTTON ON S1
5 VOLTS ON VCC
YES NO
SOLDER S1+
VCC SOLDERED
YES NO
INSPECT CABLE CONNECTION
SOLDER VCC
S4B SOLDERED TO FLEX
YES NO
S4B-C OPEN CIRCUIT
SOLDER S4B FLEX
S4B FLEX SOLDERED
YES NO
SOLDER S4B FLEX
S5 SOLDERED
YES NO
SOLDER S5
DEFECTIVE SUBSTRATE NO NPN
GROUND SOLDERED
YES NO
INSPECT CABLE CONNECTION
SOLDER GROUND
5 VOLTS ON S4B
YES NO
INSPECT CABLE CONNECTION
S4A-B SHORT CIRCUIT
YES NO
DEFECTIVE SUBSTRATE SOLENOID 1 NO DRIVE
REPAIR SHORT CIRCUIT

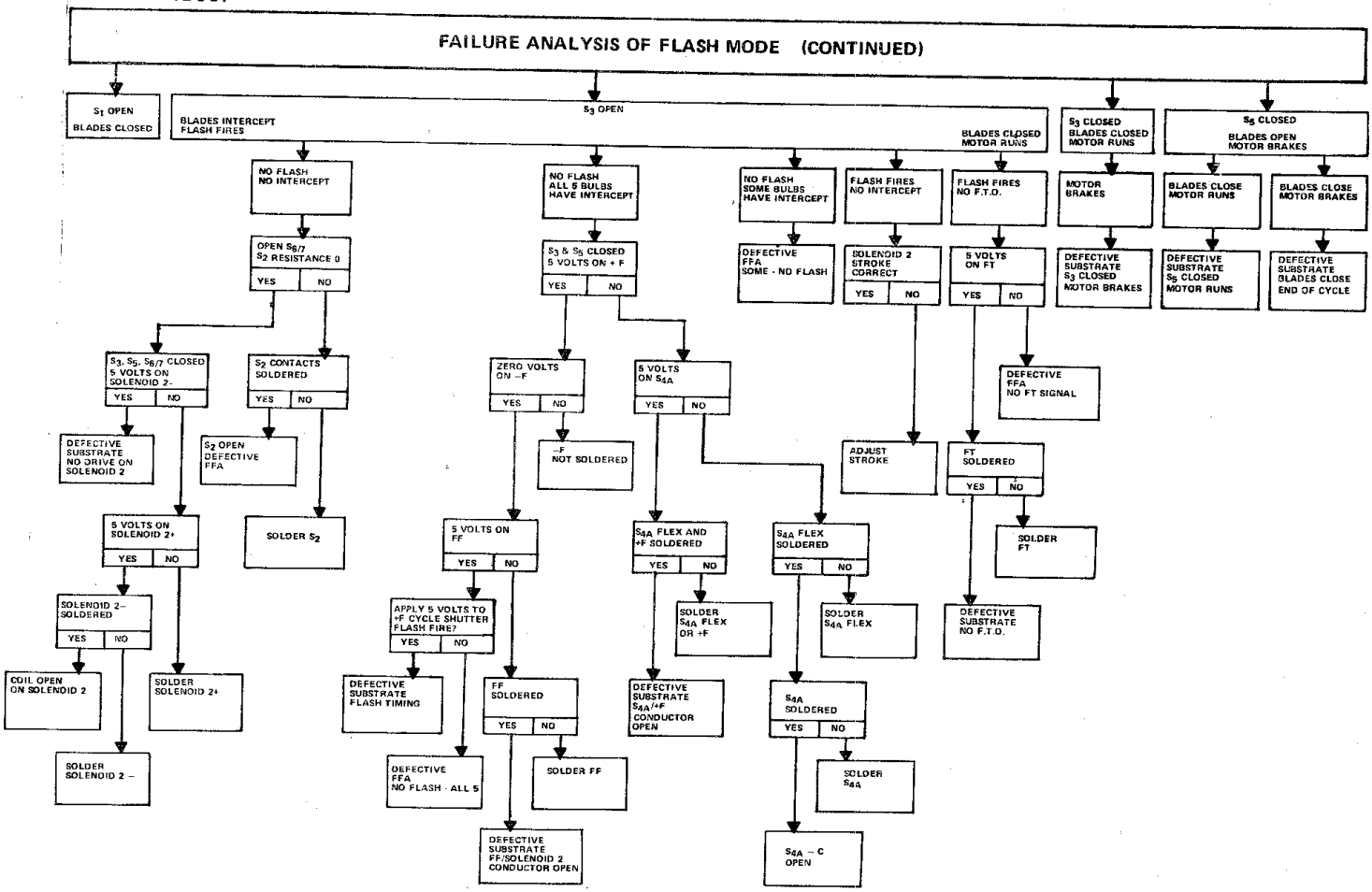

FAILURE ANALYSIS OF AMBIENT EXPOSURE MODE (CONTINUED)
S5 OPEN MOTOR BRAKES BLADES REMAIN CLOSED
S1 OPEN BLADES REMAIN CLOSED
S3 OPEN BLADES OPEN THEN CLOSE – MOTOR RUNS
S3 CLOSED MOTOR RUNS BLADES CLOSED
S5 CLOSED MOTOR BRAKES BLADES OPEN
MOTOR SLOWS TO STOP BUT NO BRAKE
MOTOR CONTINUES TO RUN
EXPOSURE OCCURS
BLADES OPEN BUT DO NOT CLOSE
BLADES ALWAYS CLOSED MOTOR OFF
BLADES CLOSED BUT MOTOR RUNS
BLADES OPEN THEN CLOSE MOTOR OFF
MOTOR BRAKES
MOTOR RUNS BLADES CLOSED
MOTOR BRAKES BUT BLADES REMAIN CLOSED
4
5
6
PNP CHECK SOLDERING
YES NO
ZERO VOLTS ON S5
YES NO
ZERO VOLTS ON S3
YES NO
FSR, RT, RC OPEN OR WRONG VALUE
YES NO
5 VOLTS ON S4B
YES NO
INSPECT CABLE CONNECTION
SOLDER PNP
DEFECTIVE SUBSTRATE NO S3 SIGNAL
INSPECT CABLE CONNECTION
DEFECTIVE SUBSTRATE NO S5 SIGNAL
DEFECTIVE SUBSTRATE NO EXPOSURE
REPLACE DEFECTIVE COMPONENT
S4B-C OPEN
DEFECTIVE SUBSTRATE NO NPN AFTER EXPOSURE
DEFECTIVE SUBSTRATE S3 CLOSED MOTOR BRAKES
DEFECTIVE SUBSTRATE S5 CLOSED MOTOR RUNS
DEFECTIVE SUBSTRATE BLADES CLOSED END OF CYCLE
S5 SHORT TO GROUND
YES NO
DEFECTIVE SUBSTRATE S5 NO SIGNAL
REPAIR SHORT CIRCUIT

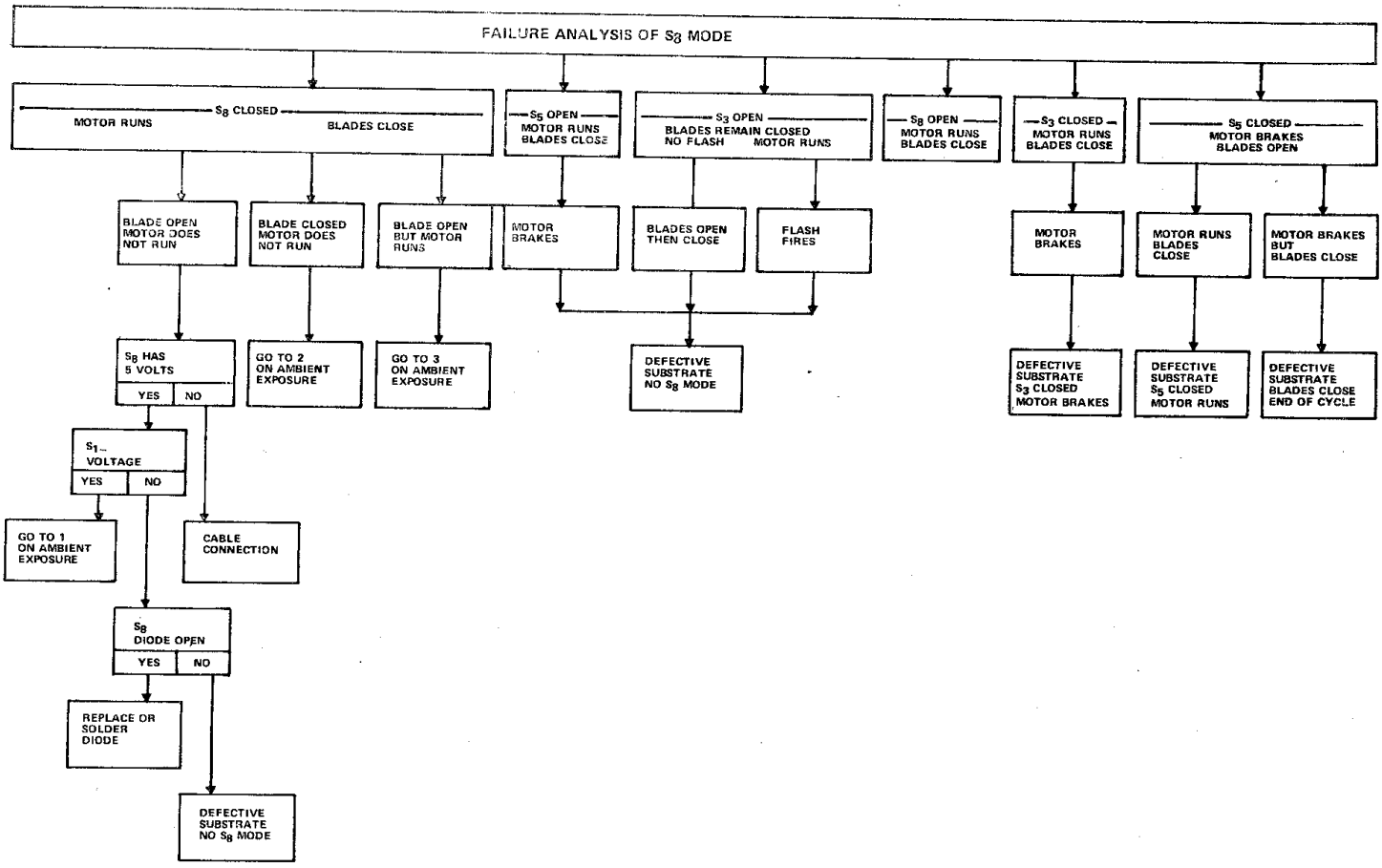

FAILURE ANALYSIS OF S6/7 CLOSURE
S6/7 – CLOSED – NO REACTION
MOTOR RUNS BLADES CLOSED
5 VOLTS ON S8
YES
NO
S8 - Vcc SHORT CIRCUIT
YES
NO
REPAIR SHORT CIRCUIT
DEFECTIVE SUBSTRATE BLADES CLOSED ON S6/7 CLOSURE
S1– VOLTAGE ON
YES
NO
DEFECTIVE SUBSTRATE BLADES CLOSED ON S6/7 CLOSURE
S1– TO Vcc SHORT CIRCUIT
YES
NO
REPAIR SHORT CIRCUIT
DEFECTIVE SUBSTRATE BLADES CLOSED ON S6/7 CLOSURE
MOTOR OFF BLADES CLOSED
SUBSTRATE TYPE
TI
FAIRCHILD
DEFECTIVE SUBSTRATE BLADES CLOSED ON S6/7 CLOSURE
S5 TO S2– OPEN CIRCUIT
YES
NO
S5 SOLDERED
YES
NO
DEFECTIVE SUBSTRATE S5 CONDUCTOR OPEN
S5 SOLDER
DEFECTIVE SUBSTRATE BLADES CLOSED ON S6/7 CLOSURE
MOTOR RUNS BUT BLADES REMAIN OPEN
SUBSTRATE TYPE
TI
FAIRCHILD
DEFECTIVE SUBSTRATE MOTOR RUNS ON S6/7 CLOSURE
S4 A-B SHORT CIRCUIT
YES
NO
REPAIR SHORT CIRCUIT
DEFECTIVE SUBSTRATE MOTOR RUNS ON S6/7 CLOSURE

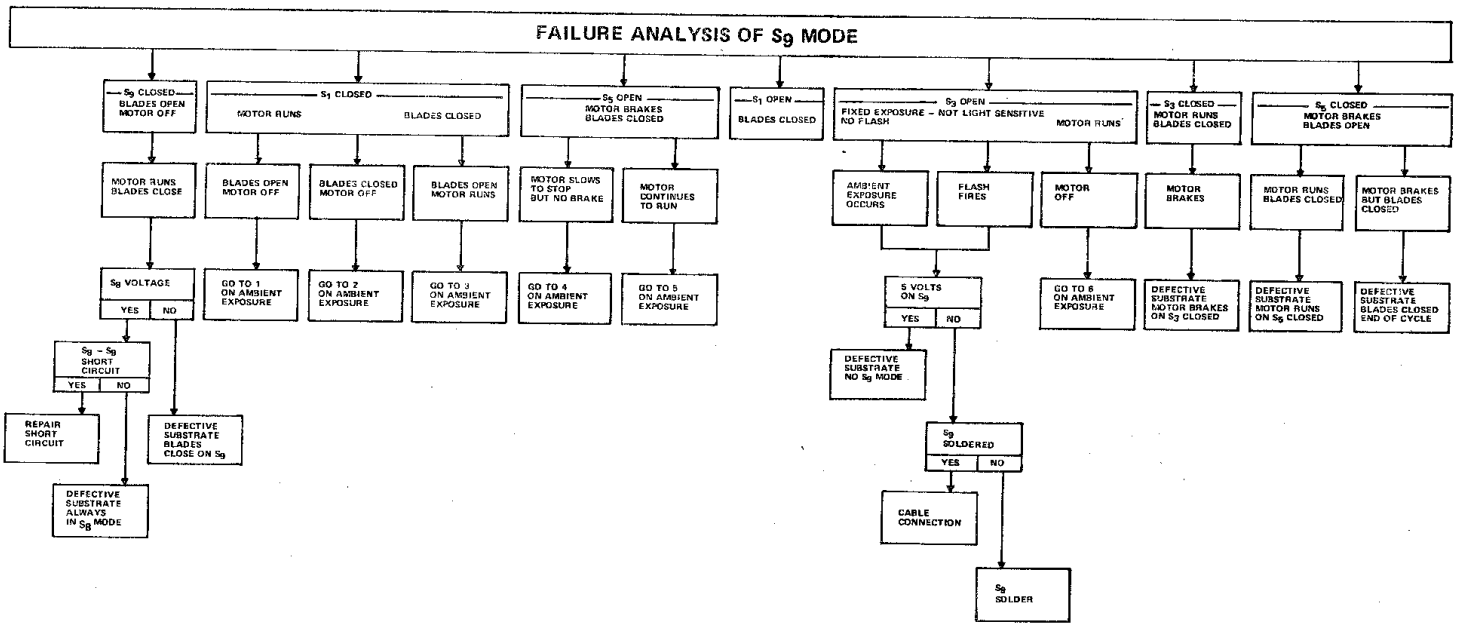

FAILURE ANALYSIS OF FLASH MODE
S_1 CLOSED
MOTOR RUNS
BLADES CLOSED
S_5 OPEN
MOTOR BRAKES
BLADES CLOSED
BLADES OPEN MOTOR OFF
BLADES CLOSED MOTOR OFF
BLADES OPEN MOTOR RUNS
MOTOR SLOWS TO STOP BUT NO BRAKE
MOTOR CONTINUES TO RUN
GO TO 1 ON AMBIENT EXPOSURE
GO TO 2 ON AMBIENT EXPOSURE
GO TO 3 ON AMBIENT EXPOSURE
GO TO 4 ON AMBIENT EXPOSURE
GO TO 5 ON AMBIENT EXPOSURE

CONTINUED ON PAGE 3-35

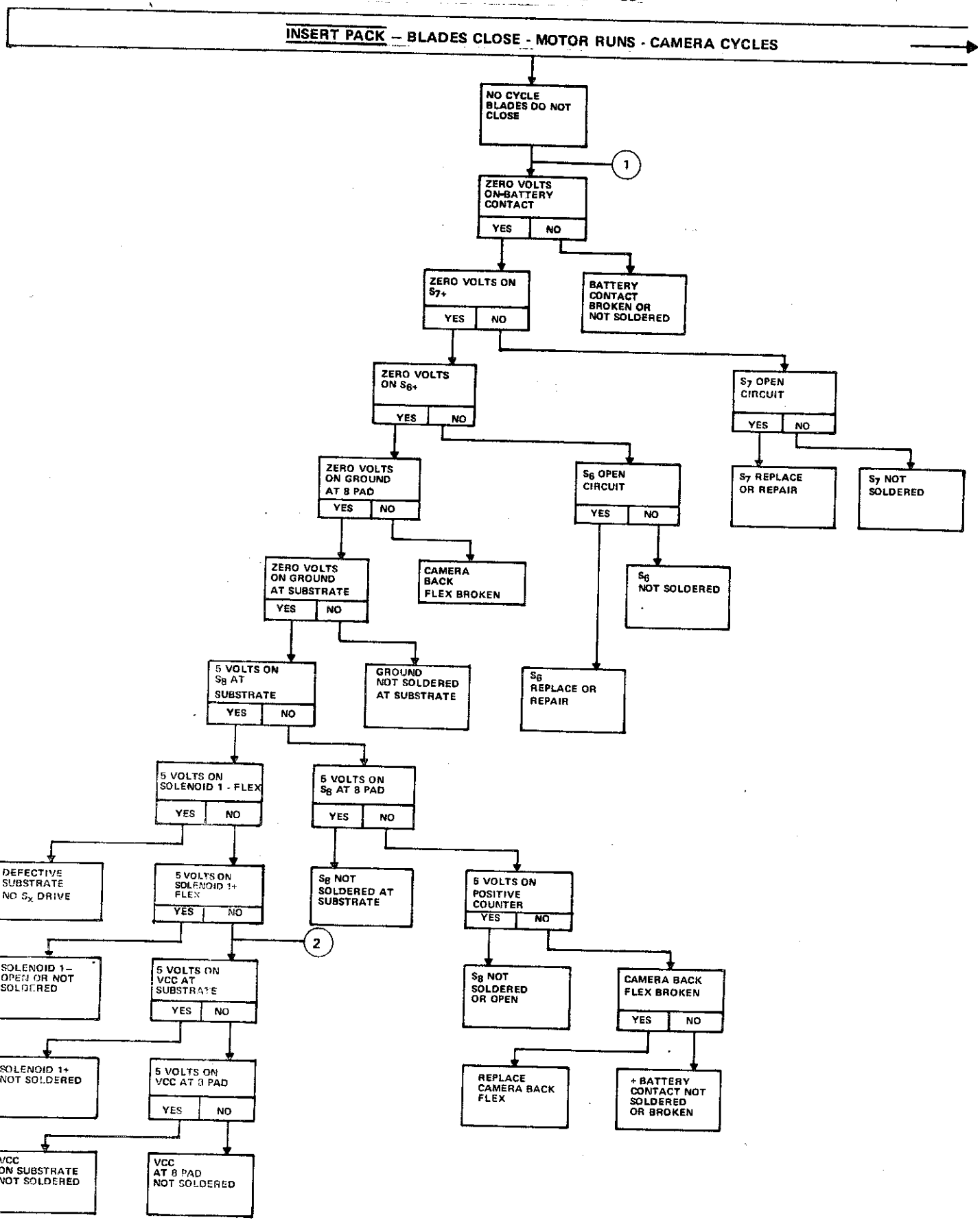
CONTINUED FROM PAGE 3-34


FAILURE ANALYSIS OF FLASH MODE (CONTINUED)
S1 OPEN BLADES CLOSED
BLADES INTERCEPT FLASH FIRES
S3 OPEN
BLADES CLOSED MOTOR RUNS
S3 CLOSED BLADES CLOSED MOTOR RUNS
S5 CLOSED BLADES OPEN MOTOR BRAKES
NO FLASH NO INTERCEPT
NO FLASH ALL 5 BULBS HAVE INTERCEPT
NO FLASH SOME BULBS HAVE INTERCEPT
FLASH FIRES NO INTERCEPT
FLASH FIRES NO F.T.O.
MOTOR BRAKES
BLADES CLOSE MOTOR RUNS
BLADES CLOSE MOTOR BRAKES
OPEN S6/7 S2 RESISTANCE 0
YES NO
S3 & S5 CLOSED 5 VOLTS ON + F
DEFECTIVE FFA SOME - NO FLASH
SOLENOID 2 STROKE CORRECT
5 VOLTS ON FT
DEFECTIVE SUBSTRATE S3 CLOSED MOTOR BRAKES
DEFECTIVE SUBSTRATE S5 CLOSED MOTOR RUNS
DEFECTIVE SUBSTRATE BLADES CLOSE END OF CYCLE
S3, S5, S6/7 CLOSED 5 VOLTS ON SOLENOID 2-
S2 CONTACTS SOLDERED
ZERO VOLTS ON -F
5 VOLTS ON S4A
DEFECTIVE FFA NO FT SIGNAL
DEFECTIVE SUBSTRATE NO DRIVE ON SOLENOID 2
S2 OPEN DEFECTIVE FFA
-F NOT SOLDERED
ADJUST STROKE
FT SOLDERED
5 VOLTS ON SOLENOID 2+
SOLDER S2
5 VOLTS ON FF
S4A FLEX AND +F SOLDERED
S4A FLEX SOLDERED
SOLDER FT
SOLENOID 2- SOLDERED
APPLY 5 VOLTS TO +F CYCLE SHUTTER FLASH FIRE?
SOLDER S4A FLEX OR +F
SOLDER S4A FLEX
DEFECTIVE SUBSTRATE NO F.T.O.
COIL OPEN ON SOLENOID 2
SOLDER SOLENOID 2+
DEFECTIVE SUBSTRATE FLASH TIMING
FF SOLDERED
DEFECTIVE SUBSTRATE S4A/+F CONDUCTOR OPEN
S4A SOLDERED
SOLDER SOLENOID 2 -
DEFECTIVE FFA NO FLASH - ALL 5
SOLDER FF
SOLDER S4A
DEFECTIVE SUBSTRATE FF/SOLENOID 2 CONDUCTOR OPEN
S4A - C OPEN

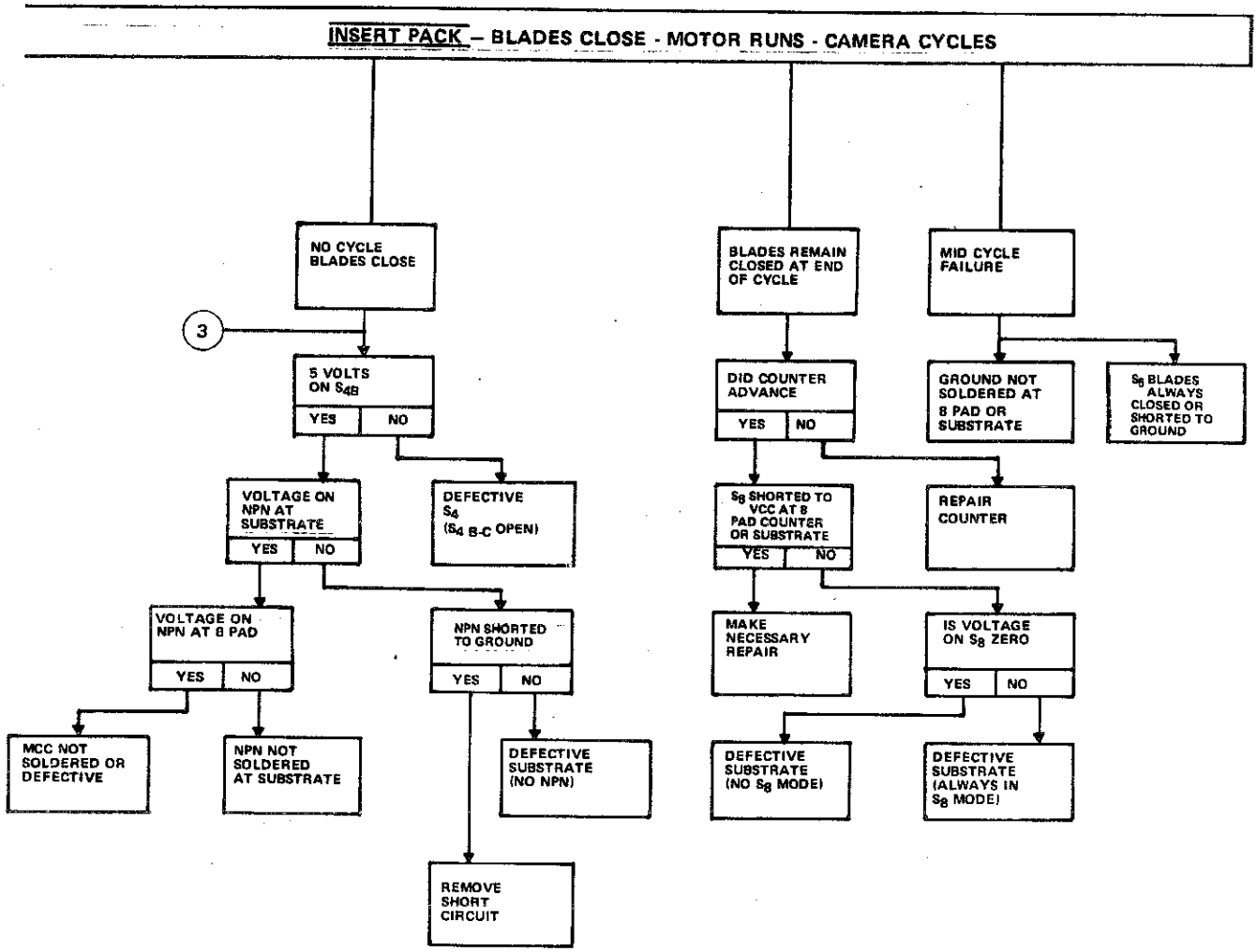

FAILURE ANALYSIS OF S8 MODE
S8 CLOSED
MOTOR RUNS
BLADES CLOSE
S5 OPEN
MOTOR RUNS
BLADES CLOSE
S3 OPEN
BLADES REMAIN CLOSED
NO FLASH
MOTOR RUNS
S8 OPEN
MOTOR RUNS
BLADES CLOSE
S3 CLOSED
MOTOR RUNS
BLADES CLOSE
S5 CLOSED
MOTOR BRAKES
BLADES OPEN
BLADE OPEN
MOTOR DOES
NOT RUN
BLADE CLOSED
MOTOR DOES
NOT RUN
BLADE OPEN
BUT MOTOR
RUNS
MOTOR
BRAKES
BLADES OPEN
THEN CLOSE
FLASH
FIRES
MOTOR
BRAKES
MOTOR RUNS
BLADES
CLOSE
MOTOR BRAKES
BUT
BLADES CLOSE
S8 HAS
5 VOLTS
YES
NO
GO TO 2
ON AMBIENT
EXPOSURE
GO TO 3
ON AMBIENT
EXPOSURE
DEFECTIVE
SUBSTRATE
NO S8 MODE
DEFECTIVE
SUBSTRATE
S3 CLOSED
MOTOR BRAKES
DEFECTIVE
SUBSTRATE
S5 CLOSED
MOTOR RUNS
DEFECTIVE
SUBSTRATE
BLADES CLOSE
END OF CYCLE
S1–
VOLTAGE
YES
NO
GO TO 1
ON AMBIENT
EXPOSURE
CABLE
CONNECTION
S8
DIODE OPEN
YES
NO
REPLACE OR
SOLDER
DIODE
DEFECTIVE
SUBSTRATE
NO S8 MODE

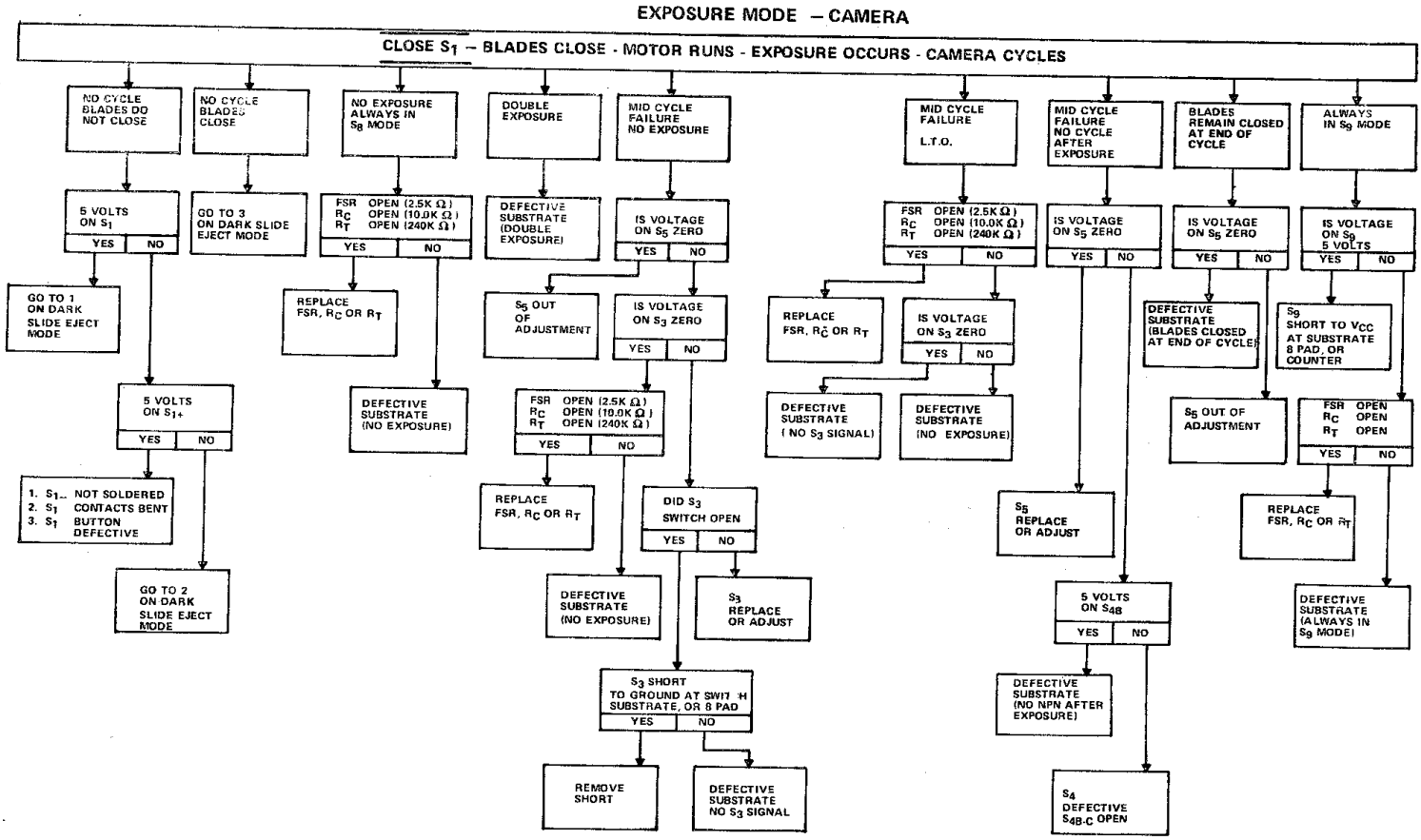

FAILURE ANALYSIS OF S_9 MODE
S_9 CLOSED
BLADES OPEN
MOTOR OFF
S_1 CLOSED
MOTOR RUNS
BLADES CLOSED
S_5 OPEN
MOTOR BRAKES
BLADES CLOSED
S_1 OPEN
BLADES CLOSED
S_3 OPEN
FIXED EXPOSURE – NOT LIGHT SENSITIVE
NO FLASH
MOTOR RUNS
S_3 CLOSED
MOTOR RUNS
BLADES CLOSED
S_5 CLOSED
MOTOR BRAKES
BLADES OPEN
MOTOR RUNS
BLADES CLOSE
BLADES OPEN
MOTOR OFF
BLADES CLOSED
MOTOR OFF
BLADES OPEN
MOTOR RUNS
MOTOR SLOWS
TO STOP
BUT NO BRAKE
MOTOR
CONTINUES
TO RUN
AMBIENT
EXPOSURE
OCCURS
FLASH
FIRES
MOTOR
OFF
MOTOR
BRAKES
MOTOR RUNS
BLADES CLOSED
MOTOR BRAKES
BUT BLADES
CLOSED
S_9 VOLTAGE
YES
NO
GO TO 1
ON AMBIENT
EXPOSURE
GO TO 2
ON AMBIENT
EXPOSURE
GO TO 3
ON AMBIENT
EXPOSURE
GO TO 4
ON AMBIENT
EXPOSURE
GO TO 5
ON AMBIENT
EXPOSURE
5 VOLTS
ON S_9
YES
NO
GO TO 6
ON AMBIENT
EXPOSURE
DEFECTIVE
SUBSTRATE
MOTOR BRAKES
ON S_3 CLOSED
DEFECTIVE
SUBSTRATE
MOTOR RUNS
ON S_5 CLOSED
DEFECTIVE
SUBSTRATE
BLADES CLOSED
END OF CYCLE
$S_9 - S_9$
SHORT
CIRCUIT
YES
NO
REPAIR
SHORT
CIRCUIT
DEFECTIVE
SUBSTRATE
BLADES
CLOSE ON S_9
DEFECTIVE
SUBSTRATE
ALWAYS
IN S_9 MODE
DEFECTIVE
SUBSTRATE
NO S_9 MODE
S_9
SOLDERED
YES
NO
CABLE
CONNECTION
S_9
SOLDER

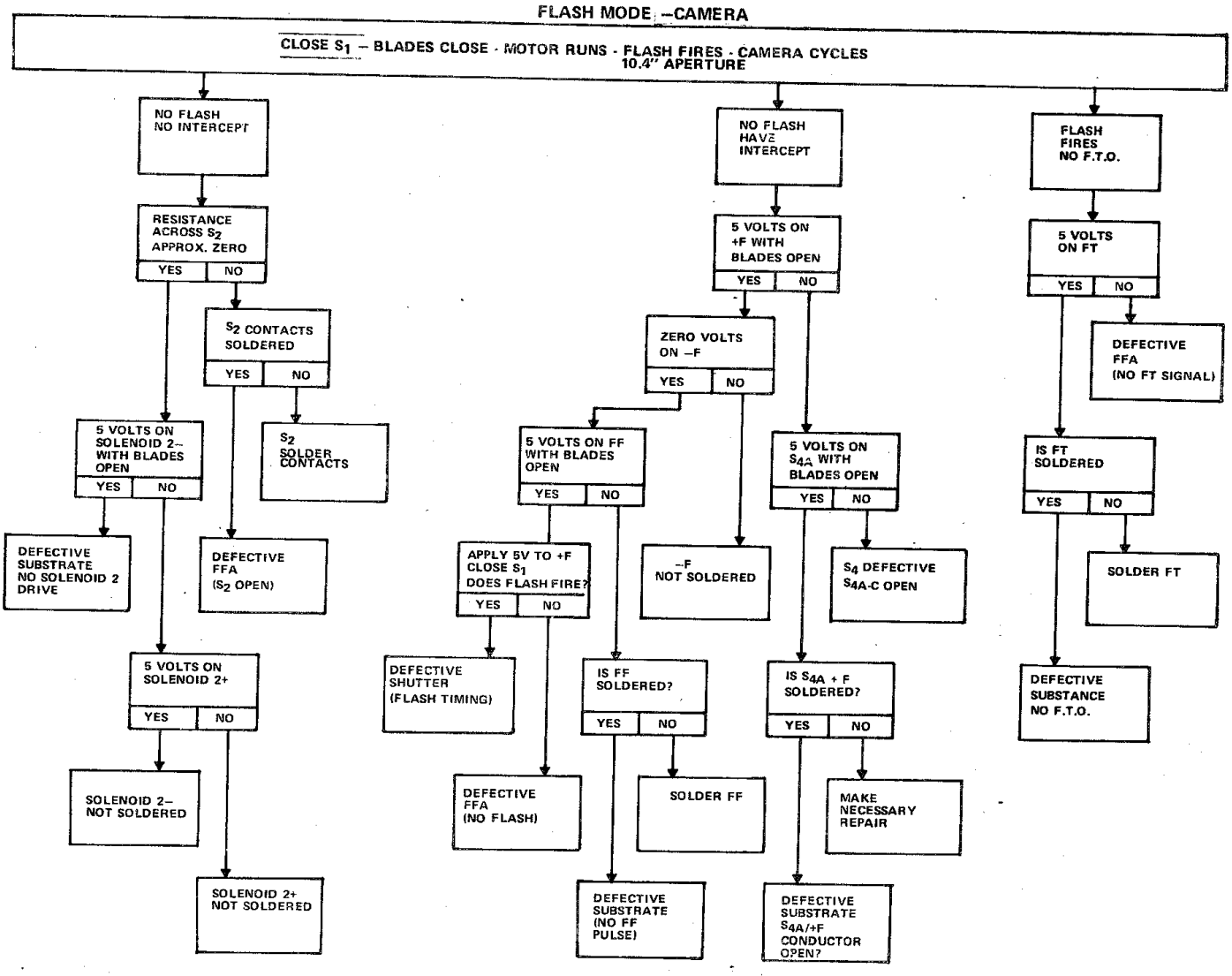
DARK SLIDE EJECT MODE – S8


INSERT PACK – BLADES CLOSE - MOTOR RUNS - CAMERA CYCLES
NO CYCLE BLADES DO NOT CLOSE
1
ZERO VOLTS ON-BATTERY CONTACT
YES NO
BATTERY CONTACT BROKEN OR NOT SOLDERED
ZERO VOLTS ON S_{7+}
YES NO
S_7 OPEN CIRCUIT
YES NO
S_7 REPLACE OR REPAIR
S_7 NOT SOLDERED
ZERO VOLTS ON S_{6+}
YES NO
S_6 OPEN CIRCUIT
YES NO
S_6 NOT SOLDERED
S_6 REPLACE OR REPAIR
ZERO VOLTS ON GROUND AT 8 PAD
YES NO
CAMERA BACK FLEX BROKEN
ZERO VOLTS ON GROUND AT SUBSTRATE
YES NO
GROUND NOT SOLDERED AT SUBSTRATE
5 VOLTS ON S_8 AT SUBSTRATE
YES NO
5 VOLTS ON SOLENOID 1 - FLEX
YES NO
DEFECTIVE SUBSTRATE NO S_X DRIVE
5 VOLTS ON SOLENOID 1+ FLEX
YES NO
SOLENOID 1– OPEN OR NOT SOLDERED
2
5 VOLTS ON VCC AT SUBSTRATE
YES NO
SOLENOID 1+ NOT SOLDERED
5 VOLTS ON VCC AT 8 PAD
YES NO
VCC ON SUBSTRATE NOT SOLDERED
VCC AT 8 PAD NOT SOLDERED
5 VOLTS ON S_8 AT 8 PAD
YES NO
S_8 NOT SOLDERED AT SUBSTRATE
5 VOLTS ON POSITIVE COUNTER
YES NO
S_8 NOT SOLDERED OR OPEN
CAMERA BACK FLEX BROKEN
YES NO
REPLACE CAMERA BACK FLEX
+ BATTERY CONTACT NOT SOLDERED OR BROKEN

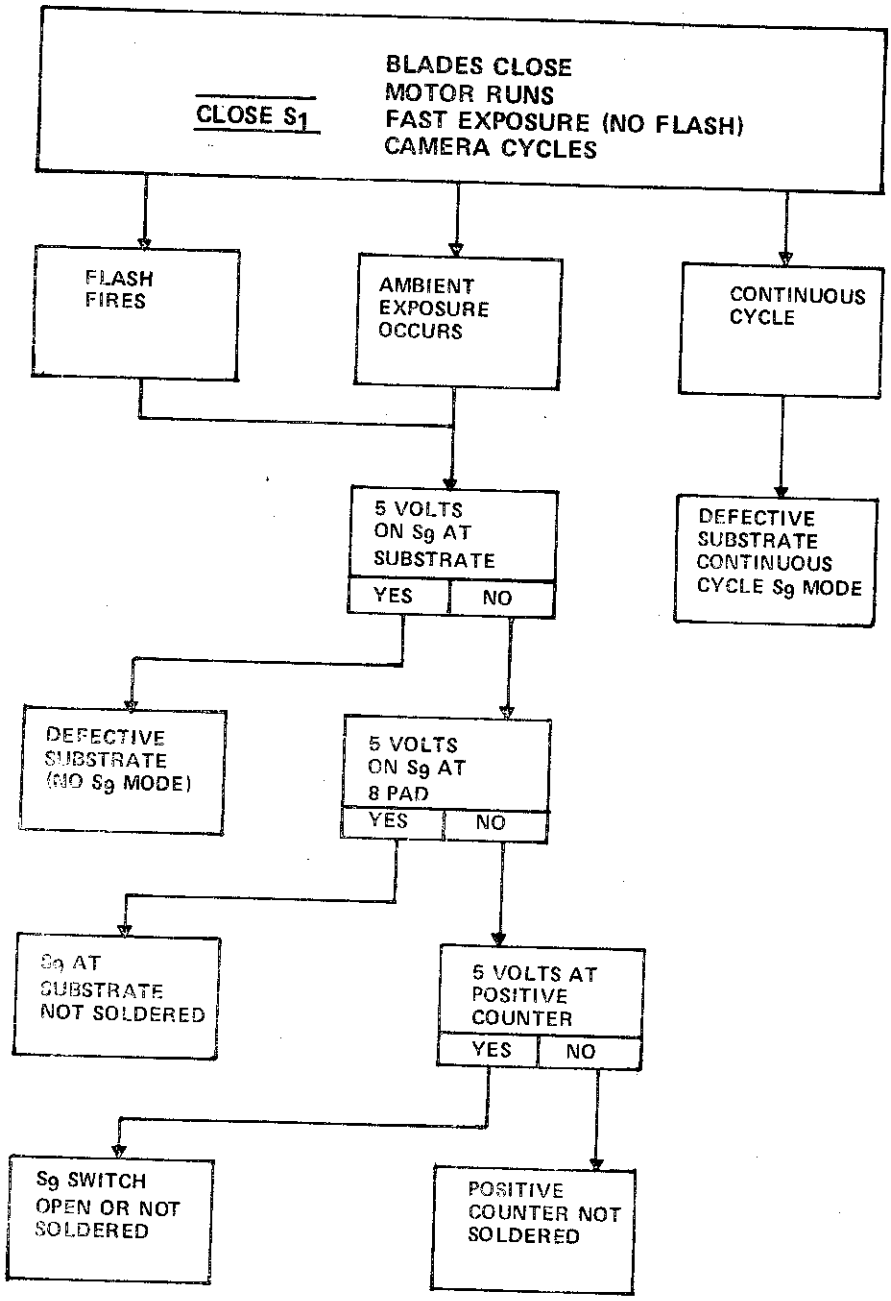
DARK SLIDE EJECT MODE – S8 (CONTINUED)




EXPOSURE MODE – CAMERA
CLOSE S_1 – BLADES CLOSE - MOTOR RUNS - EXPOSURE OCCURS - CAMERA CYCLES
NO CYCLE BLADES DO NOT CLOSE
NO CYCLE BLADES CLOSE
NO EXPOSURE ALWAYS IN S_8 MODE
DOUBLE EXPOSURE
MID CYCLE FAILURE NO EXPOSURE
MID CYCLE FAILURE L.T.O.
MID CYCLE FAILURE NO CYCLE AFTER EXPOSURE
BLADES REMAIN CLOSED AT END OF CYCLE
ALWAYS IN S_9 MODE
5 VOLTS ON S_1
YES NO
GO TO 3 ON DARK SLIDE EJECT MODE
FSR OPEN (2.5K Ω) R_C OPEN (10.0K Ω) R_T OPEN (240K Ω)
YES NO
DEFECTIVE SUBSTRATE (DOUBLE EXPOSURE)
IS VOLTAGE ON S_5 ZERO
YES NO
FSR OPEN (2.5K Ω) R_C OPEN (10.0K Ω) R_T OPEN (240K Ω)
YES NO
IS VOLTAGE ON S_5 ZERO
YES NO
IS VOLTAGE ON S_5 ZERO
YES NO
IS VOLTAGE ON S_9 5 VOLTS
YES NO
GO TO 1 ON DARK SLIDE EJECT MODE
REPLACE FSR, R_C OR R_T
S_5 OUT OF ADJUSTMENT
IS VOLTAGE ON S_3 ZERO
YES NO
REPLACE FSR, R_C OR R_T
IS VOLTAGE ON S_3 ZERO
YES NO
DEFECTIVE SUBSTRATE (BLADES CLOSED AT END OF CYCLE)
S_9 SHORT TO V_{CC} AT SUBSTRATE 8 PAD, OR COUNTER
5 VOLTS ON S_{1+}
YES NO
DEFECTIVE SUBSTRATE (NO EXPOSURE)
FSR OPEN (2.5K Ω) R_C OPEN (10.0K Ω) R_T OPEN (240K Ω)
YES NO
DEFECTIVE SUBSTRATE (NO S_3 SIGNAL)
DEFECTIVE SUBSTRATE (NO EXPOSURE)
S_5 OUT OF ADJUSTMENT
FSR OPEN R_C OPEN R_T OPEN
YES NO
1. S_1 NOT SOLDERED
2. S_1 CONTACTS BENT
3. S_1 BUTTON DEFECTIVE
REPLACE FSR, R_C OR R_T
DID S_3 SWITCH OPEN
YES NO
S_5 REPLACE OR ADJUST
REPLACE FSR, R_C OR R_T
GO TO 2 ON DARK SLIDE EJECT MODE
DEFECTIVE SUBSTRATE (NO EXPOSURE)
S_3 REPLACE OR ADJUST
5 VOLTS ON S_{4B}
YES NO
DEFECTIVE SUBSTRATE (ALWAYS IN S_9 MODE)
S_3 SHORT TO GROUND AT SWITCH SUBSTRATE, OR 8 PAD
YES NO
DEFECTIVE SUBSTRATE (NO NPN AFTER EXPOSURE)
REMOVE SHORT
DEFECTIVE SUBSTRATE NO S_3 SIGNAL
S_4 DEFECTIVE S_{4B-C} OPEN


FLASH MODE – CAMERA
CLOSE S1 – BLADES CLOSE - MOTOR RUNS - FLASH FIRES - CAMERA CYCLES 10.4" APERTURE
NO FLASH NO INTERCEPT
RESISTANCE ACROSS S2 APPROX. ZERO
YES NO
S2 CONTACTS SOLDERED
YES NO
S2 SOLDER CONTACTS
5 VOLTS ON SOLENOID 2– WITH BLADES OPEN
YES NO
DEFECTIVE SUBSTRATE NO SOLENOID 2 DRIVE
DEFECTIVE FFA (S2 OPEN)
5 VOLTS ON SOLENOID 2+
YES NO
SOLENOID 2– NOT SOLDERED
SOLENOID 2+ NOT SOLDERED
NO FLASH HAVE INTERCEPT
5 VOLTS ON +F WITH BLADES OPEN
YES NO
ZERO VOLTS ON –F
YES NO
5 VOLTS ON FF WITH BLADES OPEN
YES NO
APPLY 5V TO +F CLOSE S1 DOES FLASH FIRE?
YES NO
DEFECTIVE SHUTTER (FLASH TIMING)
DEFECTIVE FFA (NO FLASH)
IS FF SOLDERED?
YES NO
SOLDER FF
DEFECTIVE SUBSTRATE (NO FF PULSE)
–F NOT SOLDERED
5 VOLTS ON S4A WITH BLADES OPEN
YES NO
S4 DEFECTIVE S4A-C OPEN
IS S4A + F SOLDERED?
YES NO
MAKE NECESSARY REPAIR
DEFECTIVE SUBSTRATE S4A/+F CONDUCTOR OPEN?
FLASH FIRES NO F.T.O.
5 VOLTS ON FT
YES NO
DEFECTIVE FFA (NO FT SIGNAL)
IS FT SOLDERED
YES NO
SOLDER FT
DEFECTIVE SUBSTANCE NO F.T.O.

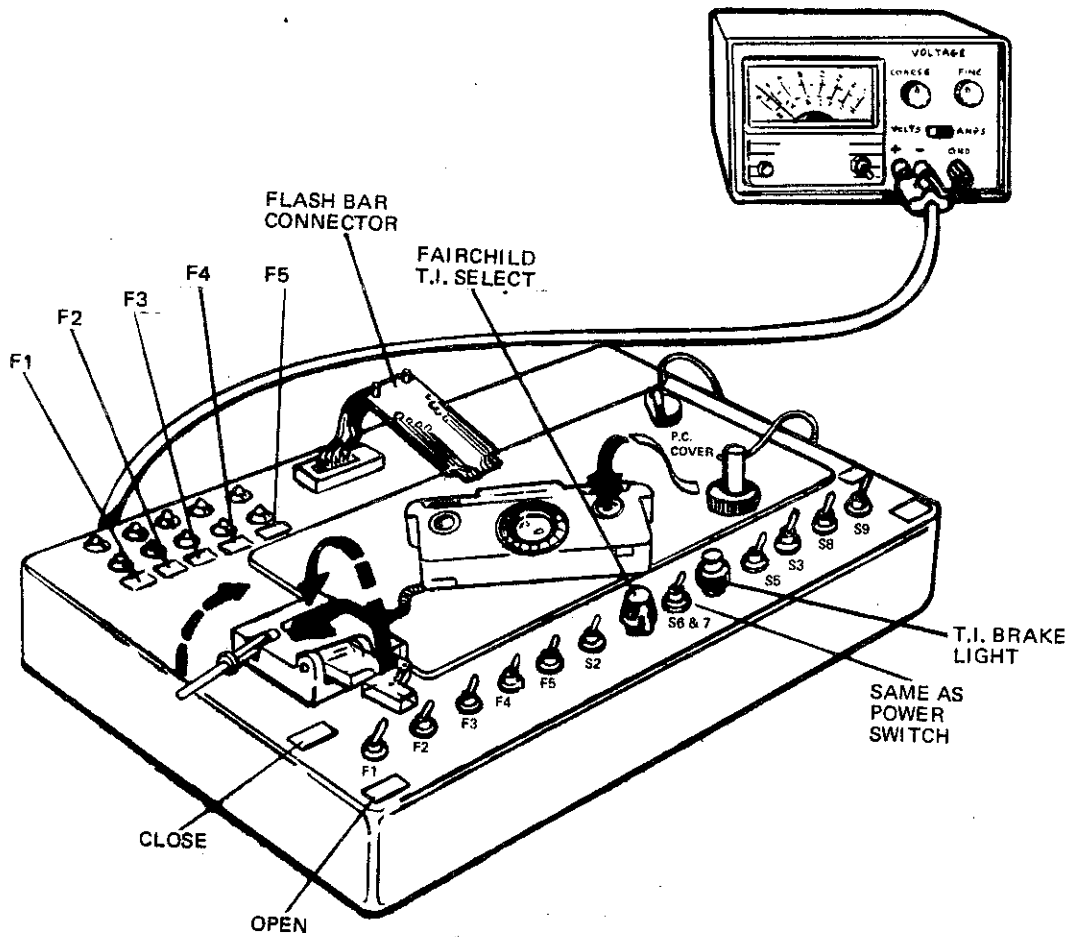
EMPTY FILM PACK MODE – S_9 –CAMERA



2. Off the Camera

To check the shutter after removing from the camera, proceed as follows:

1. Connect the Camera Back Simulator, Figure 3-28, to a Hewlett-Packard #6213A power supply, or equivalent. Set the power supply output for 5.8 volts. Switch from VOLTS to AMPS on power supply.
2. Before using power to the shutter, test with VOM for shorts between plus and minus points on the substrate and the casting. No shorts allowed.
3. Set all switches on the tester to the OPEN (top of the toggle switch pulled toward you) position except S3 – S5 and POWER.
4. During the following tests, continuously observe the ammeter readings on the power supply. Current drawn must never exceed .8 of an AMPERE.
5. Set FAIRCHILD/T.I. SELECT switch for the type of shutter to be tested.
6. Connect shutter flexible cable to special connector on the tester. Make certain that each cable lead is separated from the other and correctly positioned in the terminal block. If the shutter has a 10 lead cable, cut off the ends of leads 3 and 4 counting from the shortest lead.
7. Press S1 on the shutter to check for mechanical binding.



30032-3-28

FIGURE 3-28 CAMERA BACK SIMULATOR SYSTEM

8. Turn power to ON.

9. Close S9. Nothing should happen.

10. Close S8. Motor should run and the shutter blades close. On T.I. shutters only, the brake red light should blink.

11. Open S9. No effect.

12. Open S8. Motor should stop and the shutter blades open.

13. Press and hold down S1. The motor should run and the shutter blades close.

14. While constantly pushing S1, open S5. The motor stops and the shutter blades open. Release S1.

15. Open S3. The motor should run and shutter blades close.

16. Close S3. Should have no effect.

17. Close S5. The motor stops and the shutter blades open.

    NOTE: During all the above actions, whenever a T.I. shutter is being tested, the BRAKE light will momentarily blink on and off. This is normal; if at any time the light remains steadily ON, the subject shutter is SHORTED and must be rejected.

18. Close all the F1 through F5 switches and S2. There should be no effect.

19. Plug in the flash bar connector and cover the photocell.

20. Press S1 and hold. The motor runs and shutter blades close.

21. While still pushing S1, open S5. The motor stops and the shutter blades remain closed.

22. Open S3. The both F1 lights should flash and the motor runs, shutter blades open and close.

23. Close S3. No effect.

24. Close S5. Motor stops, blades open.

25. Open F1. Repeat steps 19 through 24 four more times opening each of the remaining F switches consecutively. Lights must flash each time at step 22 and all other requirements must be met exactly as for F1.

26. Open all switches except S3 and S5.

27. Turn power OFF.

28. Remove flash bar connector and remove shutter. The tester is now ready for another series of checks.

V. COMPREHENSIVE TESTER SPECIFICATIONS

Effective with the publication of this manual, the Comprehensive Tester currently applicable specifications are as follows:

Specifications are now available for 3 shutter configuration groups as shown in the table below.

Check shutter configuration letter before testing and make sure you test to that requirement.

COMPREHENSIVE TESTER SPECIFICATIONS

		SHUTTER CONFIGURATION					
		SHUTTERS A THRU K		SHUTTERS L & M		SHUTTERS N, P	
Ambient Mode	Light Level	Spec.	Difference Between 3 Readings	Spec.	Difference Between 3 Readings	Spec.	Difference Between 3 Readings
	6.25 c/ft^2	−.25 to +.60		+.05 to +.65		+.05 to +.65	
	100 c/ft^2	−.3 to +.3	.2 stops	−.35 to +.35	.2 stops	−.35 to +.35	.1 stops
	800 c/ft^2	0 to +.8	.3	−.2 to +.85	.3	−.25 to +.55	.2

**The reading at 100 c/ft^2 must be at least .10 stop less than the reading at 6.25 c/ft^2.*

Ambient Mode Trim		ALL CONFIGURATIONS	
		FULL LIGHT	FULL DARK
	100 c/ft^2	Deviation from nominal +.9 to +2.6 stops	Deviation from nominal −1.0 to −2.0 stops
Flash Exposure	DISTANCE	10.4" @ 800 c/ft^2	8' @ 800 c/ft^2
	SPEC.	−.35 to +.35 stops	−.4 to +.3 stops
Battery Drain	MAX. 1.15 ampere-seconds		
D.C. Ampere	MAX. 0.80 amps — read after exposure when fresnel assembly lowering in camera		

These values include inherent test equipment repeatability.

SHUTTER INTERCHANGEABILITY

Configuration	Shutter	MCC		Flex Circuits			Procedure
		F	T.I.	10	8	7	
	10 Wire T.I.	No	Yes	Yes	Yes	No	Note A
	10 Wire F	Yes	No	Yes	Yes	No	Note A
F ⟶ M	8 Wire T.I.	No	Yes	Yes	Yes	No	Note A
F ⟶ M	8 Wire F	Yes	No	Yes	Yes	No	Note A
P	7 Wire T.I.	Yes	*	No	Yes	Yes	Note B
P	7 Wire F	Yes	*	No	Yes	Yes	Note C

**T.I., MCC Part #705886, is interchangeable with Fairchild MCC Part #705819: But other T.I. MCC's are not.*

NOTE A: *Instructions for changing from a 10 wire flex circuit, to an 8 wire shutter, and 8 wire flex circuit, to a 10 wire shutter, are given in Section IV, paragraph Y-48, page 4-51. Do not use a 7 wire shutter with a 10 wire flex circuit because of the wide range of configuration differences.*

NOTE B: *To use a 7 wire Texas Instrument shutter with an 8 wire Texas Instrument flex circuit, do not make a connection to the PNP lead (#4 – see illustration) on the flex circuit, and replace the Texas Instrument MCC with a Fairchild MCC (see chart).*

NOTE C: *To use a 7 wire Fairchild shutter with an 8 wire Fairchild flex circuit, do not make a connection to the PNP lead (#4) on the flex circuit, and use the existing Fairchild MCC.*

The hinge bracket assembly must be checked to insure that #705893 assembly is on the camera body. If not, refer to Section IV, paragraph AE-8-NOTE, page 4-71.

NOTE D: *T.I. configuration P, Phase IIA shutters have exhibited a midcycle shutdown and a failure of the S8 mode. (Shutter blades stay closed – no exposure.)*

If this occurs, replace the shutter. Phase IIA shutters are identified by a diode above the solenoid 1 flex solder point. See Figure 3-30.

NOTE E: *The N configuration shutter has been produced exclusively for Fairchild type cameras. It has 8 leads, single-spring drive and a Phase IA electronics. Interchange as follows:*

1. *Use an N shutter with any Fairchild, eight pad basic camera.*
2. *Use an N shutter with a T.I., eight pad basic camera if the MCC is 705886 T.I. or 705819 F.*

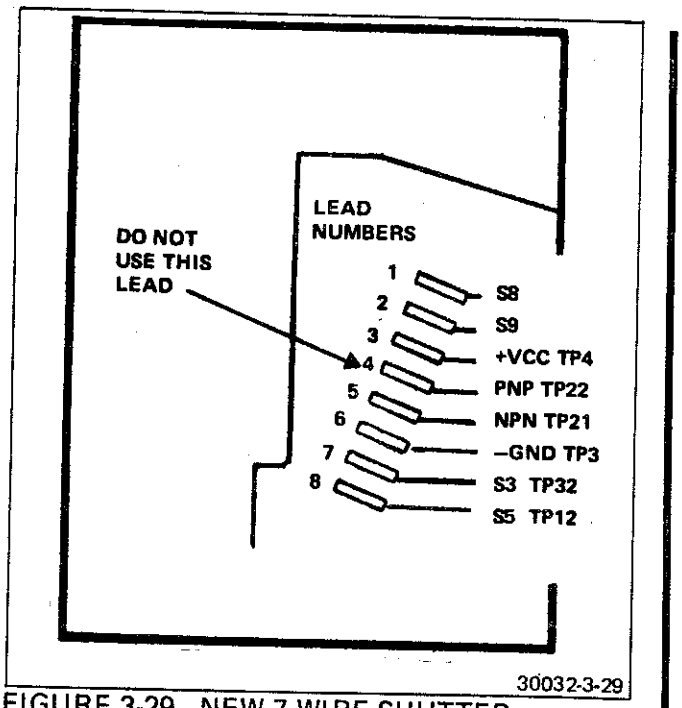


FIGURE 3-29 NEW 7 WIRE SHUTTER

3. *Observe that the shutter hinge bracket is 705893 to eliminate shutter shorting.*
4. *Observe that the front cover has the correct trim assembly actuator. For the N shutter, use front cover 705439 or 705539. The testing specifications are the same as the other configuration shutters except on the ambient mode test – see Comprehensive Tester Specifications, page 3-45.*

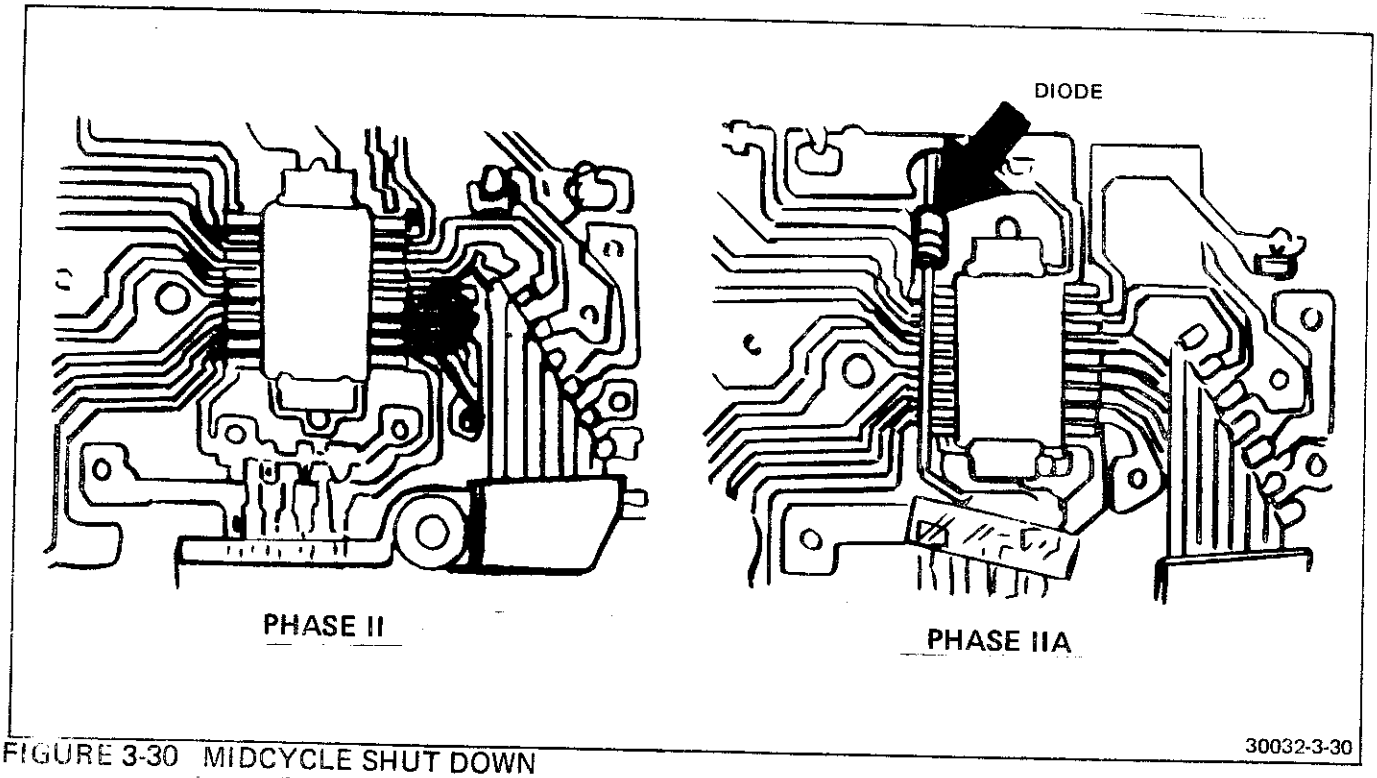


FIGURE 3-30 MIDCYCLE SHUT DOWN

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IV - REPAIR AND ADJUSTMENTS

INTRODUCTION

This section of the Manual is concerned principally with disassembly and reassembly; repair as indicated by visual inspection – uncovered broken or damaged parts, improper linkages or connections, mechanical or electrical malfunctions, – etc; and adjustments necessary to return the camera to proper operation.

The experience of the repair technician is utilized fully Since this manual is intended to be used only by personnel who have completed a training course, it does not include obvious, primary instructions. No attempt is made to suggest methods of repair. It is left to the 'on the spot' judgement of repair personnel as to the best method – if repair is easy and feasible, the repair should be made; if not, replacement of a part, sub-assembly or complete assembly is the best procedure.

Occasionally, when removing screws from the counter mounting, motor mounting areas, or the rear upper inner frame to the outerplate mounting screw, the screw holes in the plastic become stripped. To make an effective repair, use either an oversize screw or a thin sliver of plastic inserted like a shim into the hole before the screw is turned in.

A failure mode peculiar to the FAIRCHILD type shutters has been detected. A missing or loose chip has been observed to cause loss of, or erratic exposures. The particular chip (FSR) is located on the top, left side of the substrate. In some instances, a resistor has been substituted for the chip. See Figure 4-1 for precise location of the chip.

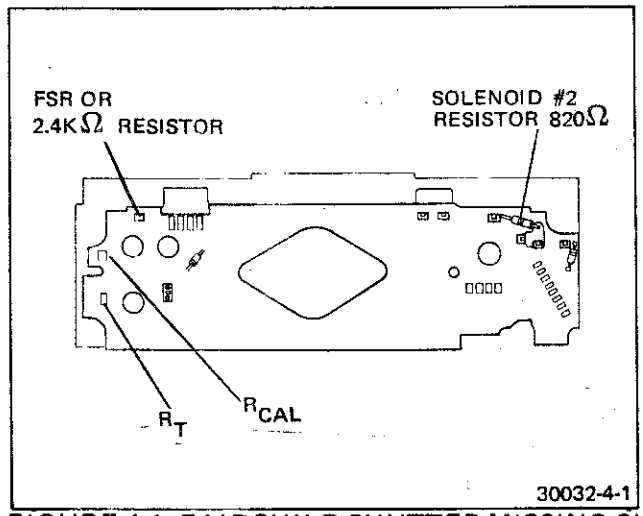

FIGURE 4-1 FAIRCHILD SHUTTER MISSING CHIP

NOTE: Peculiar also to the Fairchild shutter is camera flashing with a flashbar inserted at either S6 or S7 closure. Cause was traced to a broken or poorly connected 820 ohm resistor across the Solenoid 2 contacts. Check this whenever this trouble occurs.

A new light seal has been devised to overcome a light-leak occuring just as the film is being delivered from the rollers. The leak usually is caused by the sun shining into the left side of the rollers and, having an effect as though light were 'piped' through a conduit onto the side of the film as it emerges. All front cover configuration A or B assemblies require this light seal.

The seal is self adhesive and is placed at the end of the roller between the roller and the inside side wall of the front cover. The seal itself is recessed and molded to match exactly the contour at the end of the roller. Place the seal as described with the adhesive cover removed. Use a jeweler's screwdriver in the space between seal and end of the roller and press onto the inside of the front cover. Check alignment and compare with Figure 4-2.

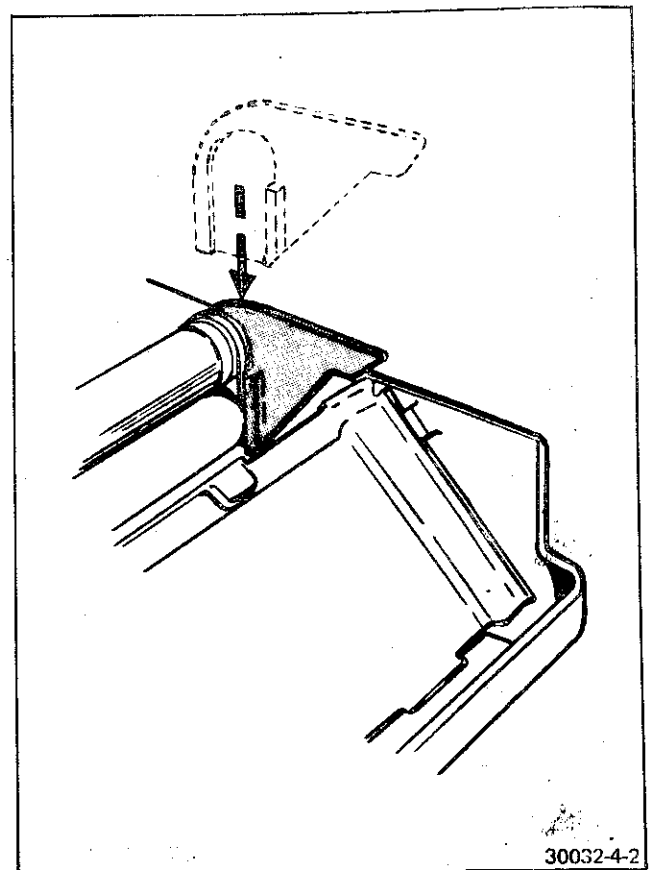

FIGURE 4-2 LIGHT SEAL APPLICATION

Pick strap position and orientation with respect to the gear pins.

The correct pick strap position is shown in Figure 4-3 below. To view the pick strap as seen in the drawing, remove the front cover and place a light at the opening to the film compartment, then look through the rear of the erecting link slot across the empty film compartment. If the pick strap does not assume the same position as shown in the drawing, it can be bent into the proper shape and orientation by use of the Special Tool #11755.

To use, insert the tool through the erecting link slot and catch the strap in the slot in the tool. Rotate the tool handle to bend the strap either way to its correct position.

A. MIRROR COVER ASSEMBLY, REMOVE

The mirror cover assembly consists of the mirror cover, the boot, and the viewing mirror. Because of its construction, it is not feasible to disassemble the mirror cover assembly itself and, therefore, whenever one of its major components fails, the entire assembly is replaced. The mirror cover could sustain damage in the form of cracks or broken hinges, or overall distortion. The boot could be cut, torn or damaged by wear. The mirror could be loose or displaced in its mount, broken, or its surface damaged beyond cleaning type repair. Should any of these faults be evidenced, replace the assembly in the following manner.

NOTE: When changing Mirror Cover and Fresnel assemblies, correct color coding must be employed to prevent unacceptable tolerance buildup. This is usually demonstrated by difficult closing of the camera, etc.

The chart below shows the color codes to be used; i.e., a red coded Fresnel goes with either a red, yellow, blue or white Mirror Cover; not with a green Mirror Cover. The choice should be the first in order in the chart. Red first, yellow second, etc.

The color code is located, on the Mirror Cover, on the underside, upper right-hand corner, viewed as if holding the camera to take pictures; on the Fresnel assembly, it is marked on the protective paper at the point where the adhesive seals the paper seal around the Fresnel.

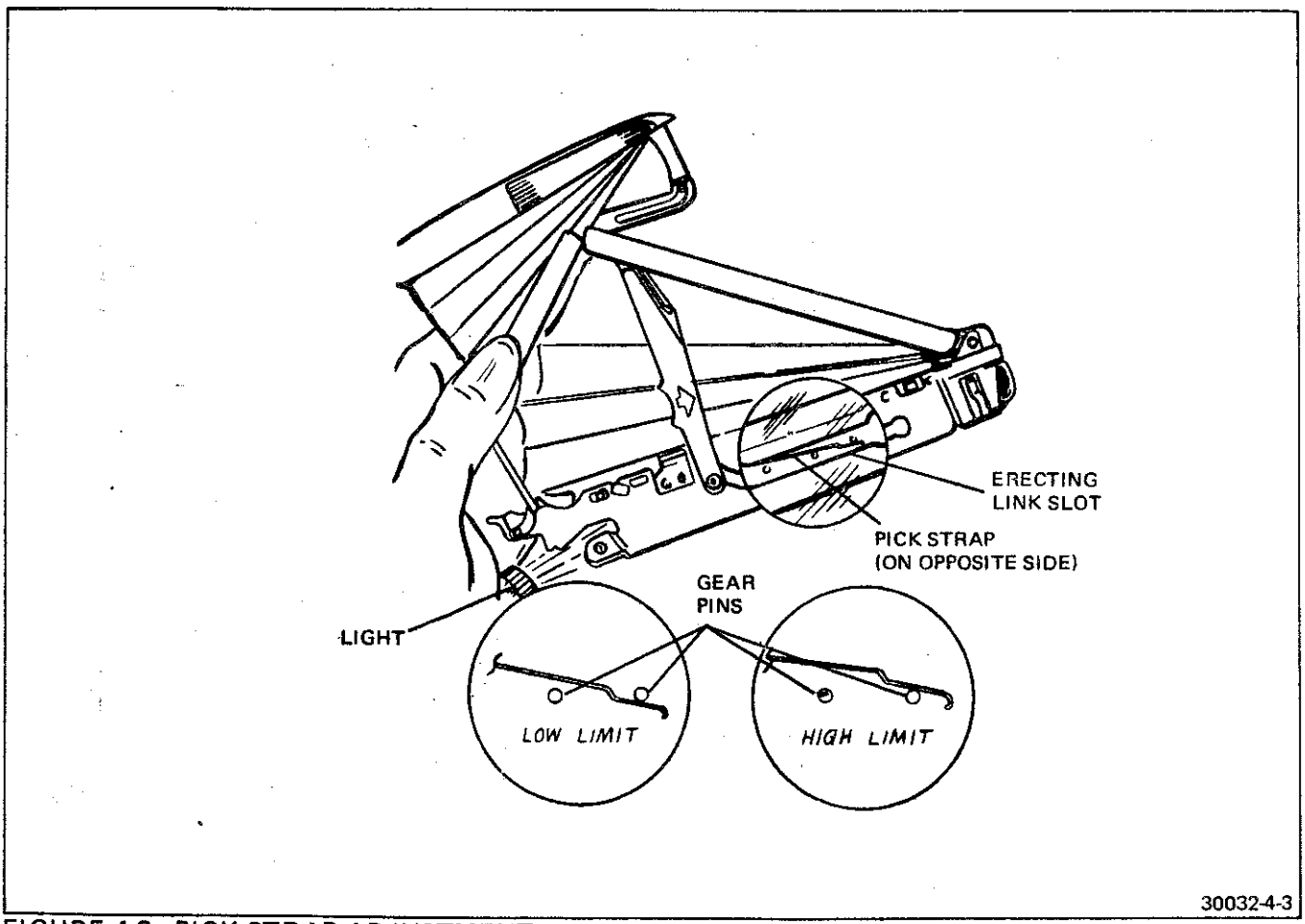

FIGURE 4-3 PICK STRAP ADJUSTMENT

COLOR CODES USED WHEN CHANGING FRESNELS AND MIRROR COVERS

Fresnel	MIRROR COVER				
	Red	Yellow	Blue	Green	White
Red	x	x	x		x
Yellow	x	x	x	x	x
Blue	x	x	x	x	
Green	x	x	x	x	
Black	x	x			

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front-cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. On newer models detach the front cover from the right side (gear side) only.
4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In the following step, the bottom cover will be removed. To prevent damage to the flex circuit, insert a thin strip (a small, metal, six-inch pocket scale, for example) between the flex circuit and the inside cover surface. Move the tool from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Lift the cover a small distance away from the camera, then slide the cover from the assembly.
8. Remove the inner-frame-to-boot-retainer screws (see Figure 4-4).
9. Remove the four shutter housing retaining screws from the rear of the shutter mounting hinge bracket (see Figure 4-5).

Caution: While the shutter is detached from the mounting bracket, make sure no mechanical stress is put on the ribbon cable.

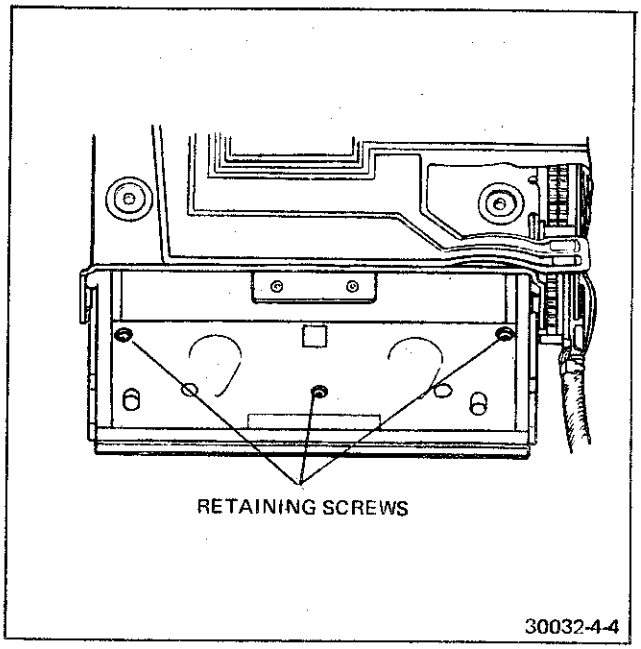

FIGURE 4-4 BOOT RETAINING SCREWS

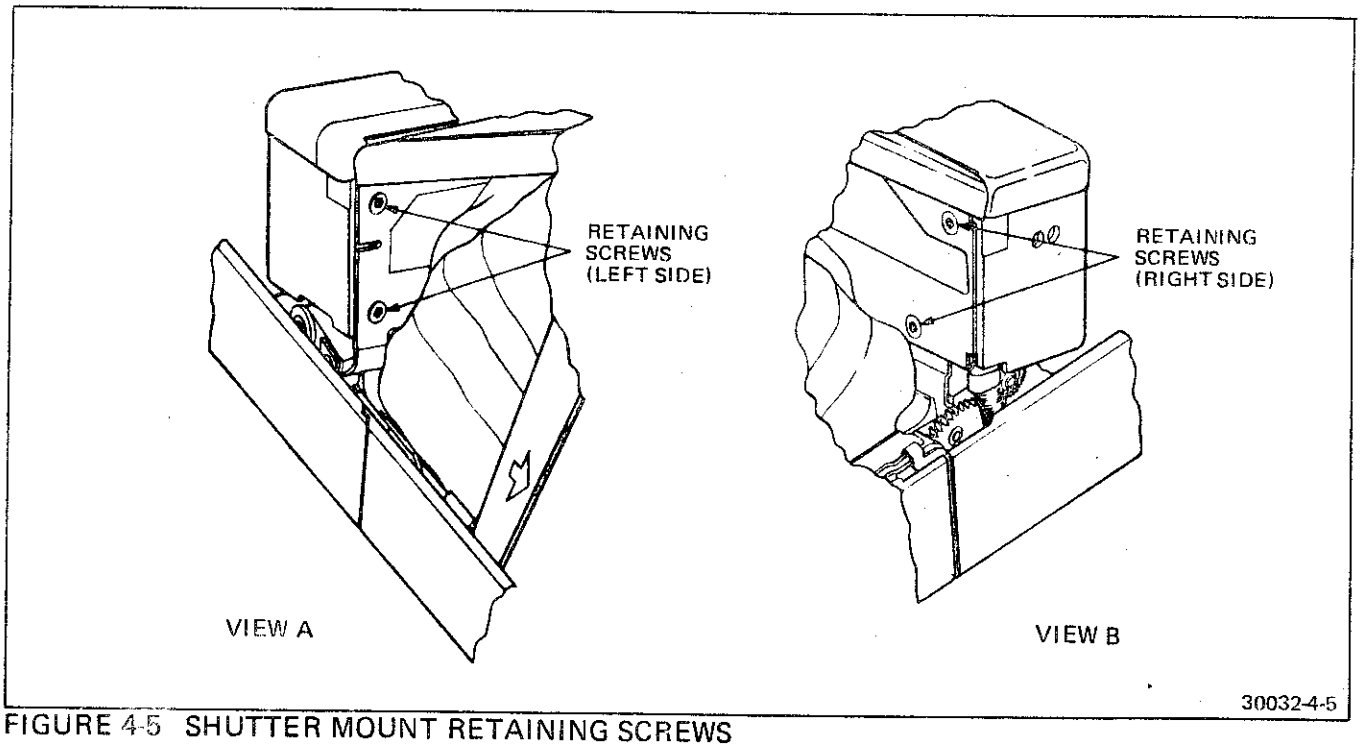

FIGURE 4-5 SHUTTER MOUNT RETAINING SCREWS

10. Remove the two hinge-bracket-to-boot-retainer screws located adjacent to the round lens opening in the shutter hinge bracket.
11. Using Special Tool #11665, remove the two short-cover-to-mirror-cover hinge pins (Figure 4-6).

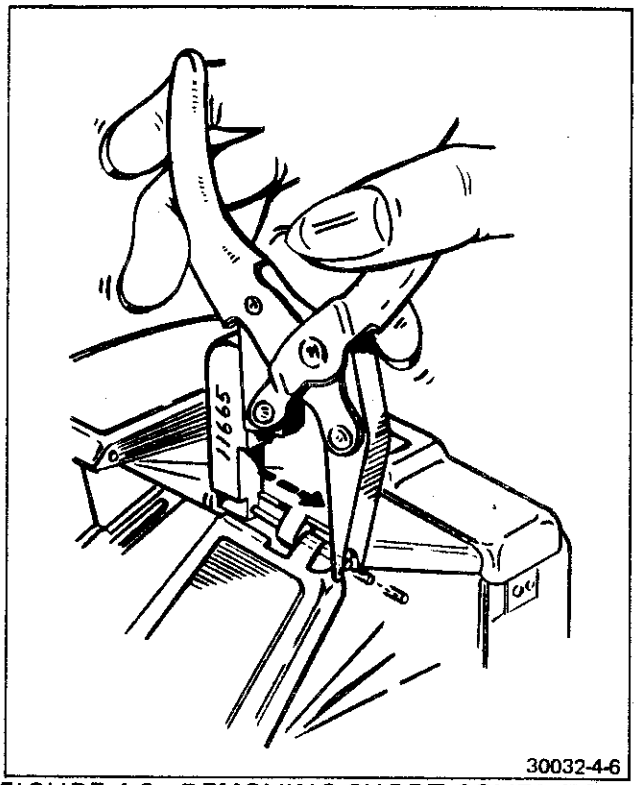

FIGURE 4-6 REMOVING SHORT-COVER-TO-MIRROR COVER HINGE PINS

12. Using Special Tool #11719, remove the mirror-cover-to-inner-frame hinge pins (Figure 4-7).

NOTE: Frequently, when removing a mirror cover assembly, the boot retaining tab becomes damaged. A fix for this problem has been devised. Proceed as follows:

a. Remove the light seal.

b. Use a No. 62 twist drill in a pin vise and drill a hole 1/8" deep, dead center in the boot retaining tab (Figure 4-8). Hold the boot retainer tightly between thumb and forefinger.

c. Use a .0096 tap and cut threads in the drilled hole.

d. Secure the boot retainer tab with a .0096 3/32" round head brass screw.

e. Replace the light seal and either heat stake or glue it in position.

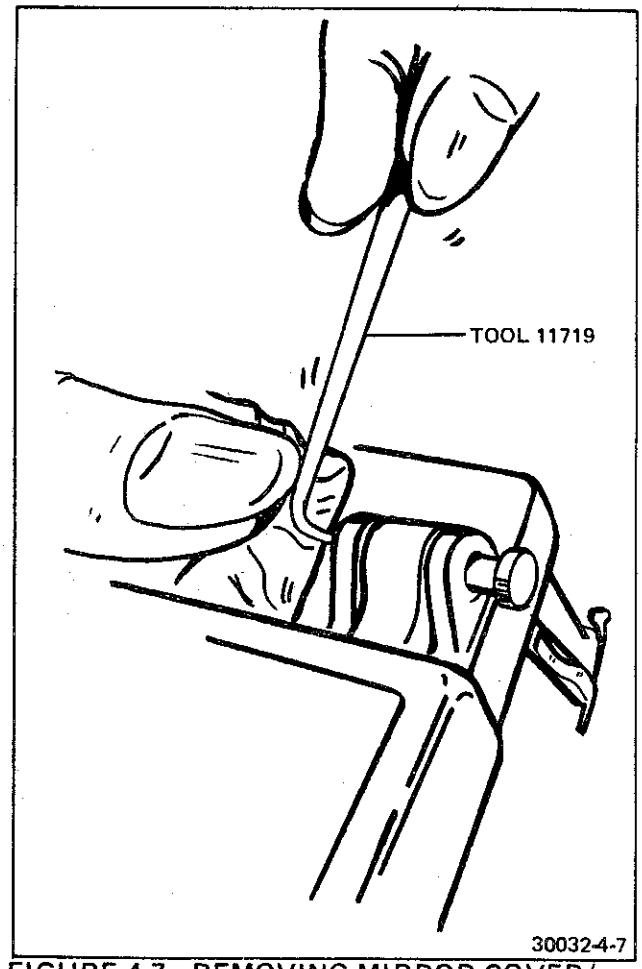

FIGURE 4-7 REMOVING MIRROR COVER/ INNER FRAME HINGE PINS

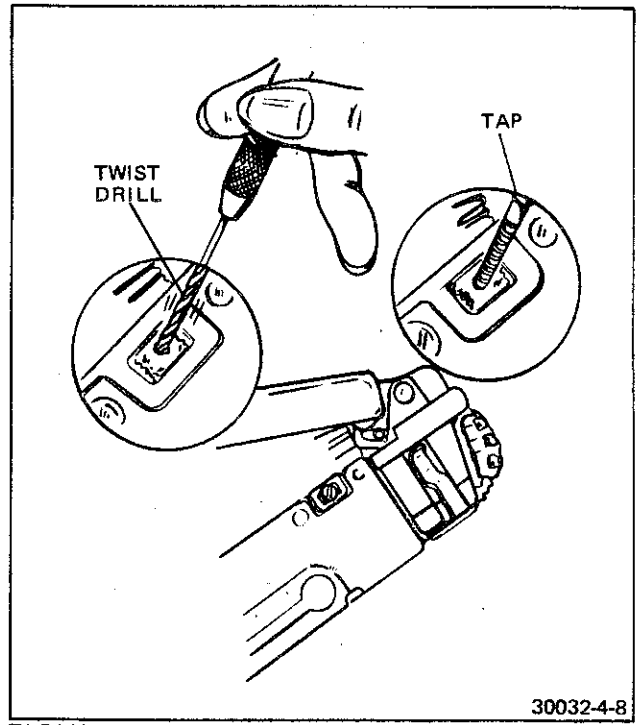

FIGURE 4-8 REPAIRING DAMAGED BOOT RETAINER TAB

f. Paint or mark a white dot under the light seal to warn that a screw fix has been made (Figure 4-9).

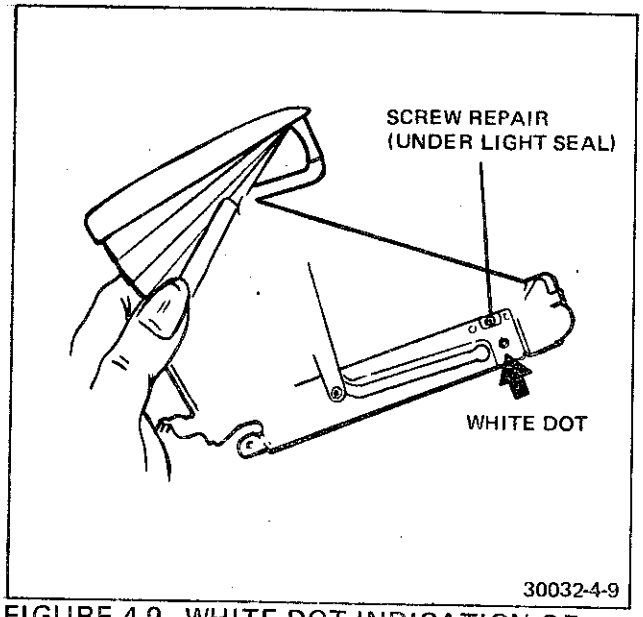

FIGURE 4-9 WHITE DOT INDICATION OF SCREW REPAIR TO BOOT RETAINER TAB

g. If the repair has to be made on the gear train side, the entire gear assembly first has to be removed.

Caution: Before continuing with step 13, look for a white dot painted under the light seal on the upper right side of the bottom plate (Figure 4-9). If the dot is there, it means that a previously broken boot tab has been repaired by using a screw. In this event, you cannot snap off the retainer as described in the next paragraph.

13. Referring to Figure 4-10, note orientation of the handle; this must be as shown to prevent damage to tool and/or camera. Insert boot remover, Special Tool #11698, into the film compartment of the camera. Note that the plunger handle is out, away from the body of the tool. Be sure the body of the tool is fully seated in the film compartment.

14. Firmly push the boot remover handle in to free the boot from the inner frame tabs. Push until a click is heard and the tool bottoms.

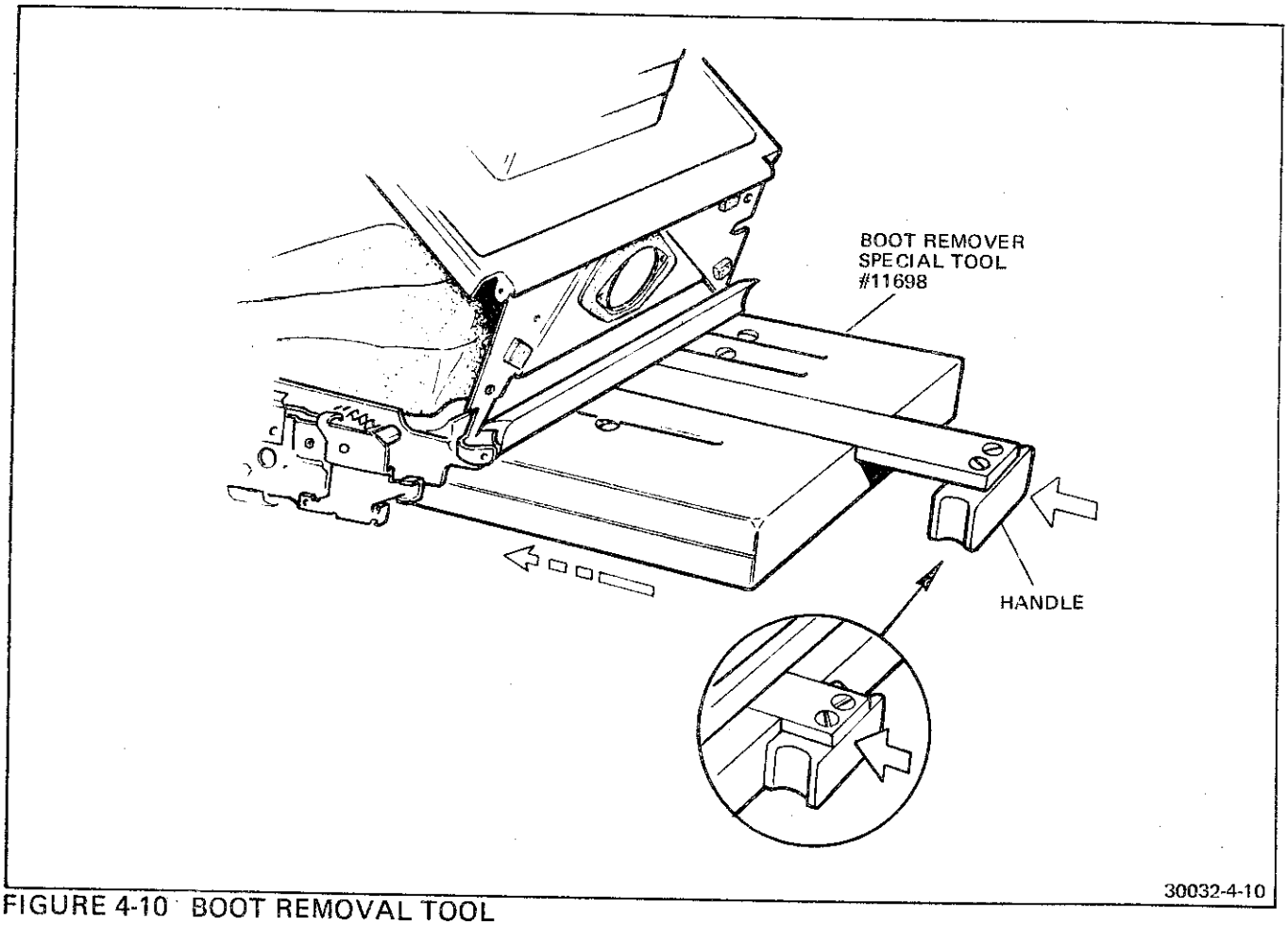

FIGURE 4-10 BOOT REMOVAL TOOL

15. Grasp the boot and gently pull it up, first one side, then the other away from the tabs.
16. Pull the plunger handle out and remove the tool from the camera.
17. Slide the erecting link to the end of its slot and disengage the link. Remove boot complete with erecting link connected, being careful not to scratch the surface of the Fresnel screen.

B. MIRROR COVER ASSEMBLY, INSTALL

1. Insert the roller on the end of the erecting link through the hole at the end of the curved slot and slide the link into position.
2. Hold the cover assembly in such a position that the S6 actuator hangs straight down.
3. Lower the housing so that the free-hanging actuator passes through the cutout in the inner-frame assembly toward the S6 contacts (see Figure 4-11).

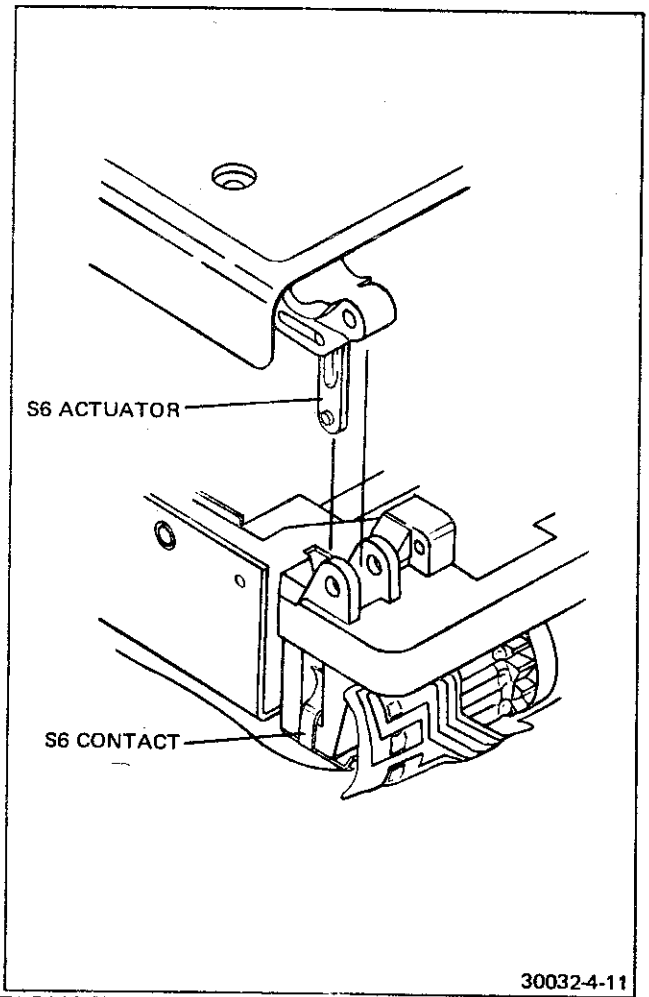

FIGURE 4-11 LOCATION OF S6 ACTUATOR LINK

4. Snap the boot retainer over the tabs on the inner frame (see Figure 4-12).

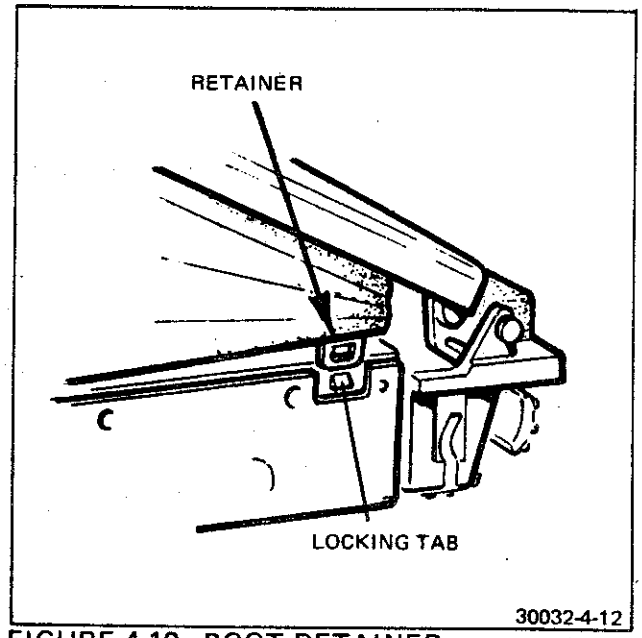

FIGURE 4-12 BOOT RETAINER

5. Re-install the two mirror-cover-to-inner-frame hinge pins.
6. Re-install the two mirror-cover-to-short-cover hinge pins.
7. Install and tighten the two shutter-bracket-to-boot-retainer screws.
8. Align the shutter locating pins with their holes (Figure 4-13) and install the four mounting screws.
9. Identify the second gear from the motor end of the gear train. Rotate this gear in a counter-clockwise direction until the mirror is in a picture-taking position.
10. Install and tighten the inner-frame-to-boot retainer screws.
11. Check the camera for proper operation and/or light leaks.
12. Re-install the bottom cover. Install and tighten the four screws.
13. Check the camera for proper operation.
14. Replace the front cover by squeezing the sides of the cover just enough to engage the pivot points.
15. Check the camera for proper operation.
16. Replace the decorative leather covering on the bottom cover.

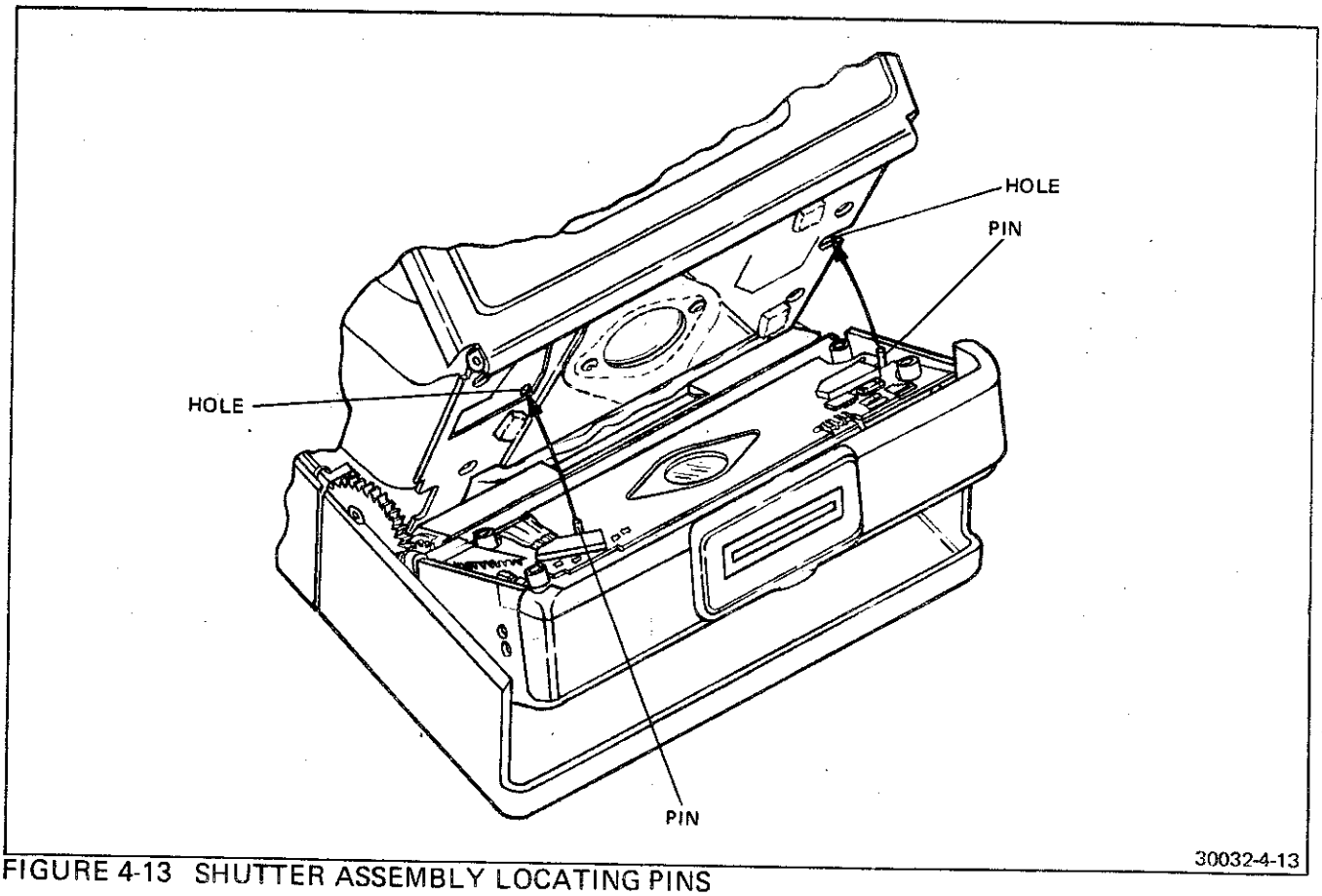

FIGURE 4-13 SHUTTER ASSEMBLY LOCATING PINS

C. S6 ACTUATOR, REMOVE

The S6 actuator is a mechanical link which causes the erecting of the camera to close S6 which, in turn, closes the primary battery circuit. The actuator is not accessible when the camera is assembled and, therefore, it is not frequently subjected to damage by mishandling. It is, however, subject to wear and fatigue and, together with the switch itself, is suspect whenever battery power fails to reach the camera's electronic circuitry. The following procedures explain the method of removing and reinstalling the S6 actuator.

1. Erect the camera to picture-taking configuration.
2. Open the front cover by depressing the front cover release latch on the right side of the camera bed.
3. Apply pressure to the side of the cover adjacent to the cover hinge area. Press toward the gear-train side of the camera. A very small amount of movement in this direction will free the pivot from its mount and allow the front cover to be removed.
4. Remove the decorative leather covering from the bottom cover.
5. Remove the four bottom-cover retaining screws.
6. In this step, the bottom cover will be removed. To prevent damage to the flex circuit, lift the end of the cover a small distance to permit insertion of a thin metal or plastic strip (a small, metal, six-inch pocket scale is suitable) between the flex circuit and the inside cover surface. Move the strip from one locating stud to the other as the cover is being removed to prevent sticking to the flex circuit.
7. Slide the cover from the assembly.
8. Remove the inner-frame-to-boot-retainer screws. See Figure 4-14.

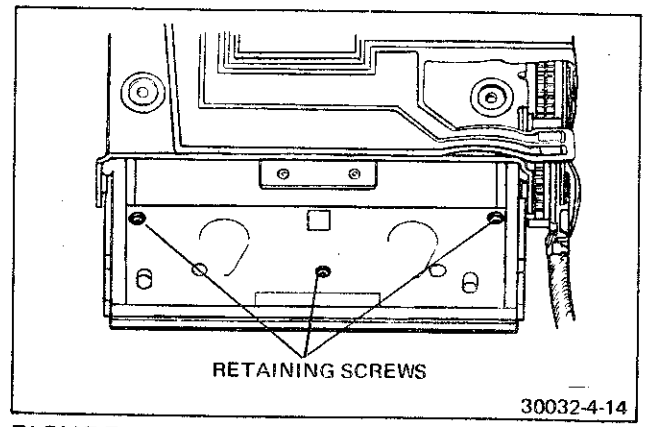

FIGURE 4-14 BOOT RETAINING SCREWS

9. Remove the mirror-cover-to-inner-frame hinge pins.
10. Referring to Figure 4-10, note orientation of the handle; this must be as shown to prevent damage to tool and/or camera. Insert boot remover Special Tool #11698 into the film compartment of the camera. Note that the plunger handle is out, away from the body of the tool. Be sure the body of the tool is fully seated in the film compartment.
11. Firmly push the boot remover handle in to free the boot from the inner frame tabs. Push until a click is heard and the tool bottoms.
12. Grasp the boot and gently pull it up, first one side, then the other from the tabs.
13. Pull the plunger handle out and remove the tool from the camera.
14. Slide the erecting link to the end of its slot and disengage the link. Remove boot complete with erecting link connected, being careful not to scratch the surface of the Fresnel screen.

    NOTE: If the Special Tool # 11698 is not available, follow the method below.

15. Identify the second gear from the motor end of the gear train. Rotate this gear in a counter-clockwise direction until the pick slide reaches the end of its travel and is captured by the pick latch.
16. Refer to Figure 4-15. Use a narrow-blade jeweler's screwdriver. While pulling the corner of the mirror cover away from the frame, depress the boot retainer tab to clear the retaining stud. Release the pressure as soon as the tab snaps free.

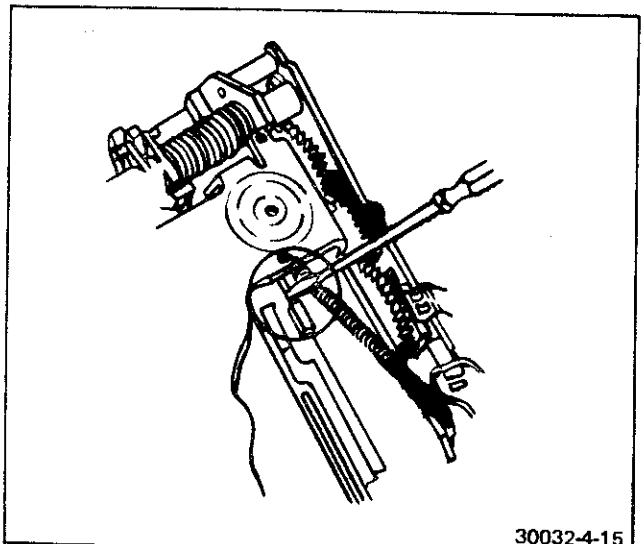

FIGURE 4-15 RELEASE BOOT RETAINER TAB

17. Rotate the gear further in the counter-clockwise direction until the pick slide is released and snaps forward.
18. Use the jeweler's screwdriver and, while pulling the boot away from the frame, pry off the second tab.
19. Remove the S6 actuator. Use a small drift pin and carefully drive out the S6 actuator cam pin.

D. S6 ACTUATOR, INSTALL

1. To install the replacement actuator, place the actuator in position in the slot of the mirror-cover hinge. (The actuator is symmetrical and can be installed in any position.)
2. Reinsert the actuator cam pin and press it into place.
3. Insert roller of erecting link into track.
4. Hold the cover assembly in such a position that the S6 actuator hangs straight down.
5. Lower the housing so that the free-hanging actuator passes through the cutout in the inner frame assembly toward the S6 contact. (See Figure 4-16.)

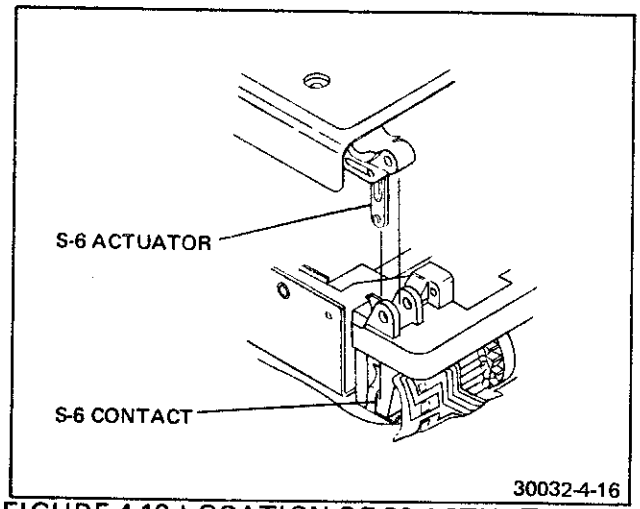

FIGURE 4-16 LOCATION OF S6 ACTUATOR LINK

6. Snap the boot retainer over the tabs on the inner frame.
7. Reinstall the two mirror-cover-to-inner-frame hinge pins.
8. Identify the second gear from the motor end of the gear train. Rotate this gear in a counter-clockwise direction until the mirror is in a picture-taking position.
9. Install and tighten the inner-frame-to-boot retainer screws.